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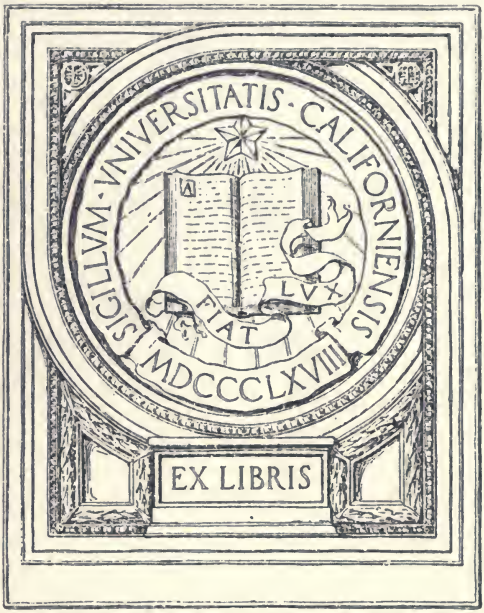
WOOL

FRANK ORMEROD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STAPLE TRADES AND INDUSTRIES
EDITED BY GORDON D. KNOX

WOOL

FRANK ORMEROD

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"THE LANDS WHERE MILLIONS OF SHAGGY-COATED SHEEP ARE BEING RAISED"

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STAPLE TRADES AND INDUSTRIES
Edited by GORDON D. KNOX

WOOL

BY
FRANK ORMEROD

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UNIV. OF
CALIFORNIA

EDITOR'S PREFACE

To-day the world is faced with an expenditure so vast that only a rapid development of trade can restore prosperity. Various steps have been taken by the Governments to spread a greater knowledge of trading conditions all over the world. Government activity, however, has never succeeded in creating a nation's trade and must inevitably be dependent on the initiative of the trading community.

Every year, partly because of and partly in spite of the increasing specialisation of trade, the need becomes greater for the closest possible study of the national trade. And a study of the national trade involves a close knowledge of trade conditions throughout the whole world. Experience in every department of life has shown the weakness of purely *ad hoc* knowledge. Much has to be learnt by all classes of the community that has no direct bearing on their immediate concerns, and the penalty for not acquiring such knowledge is a narrowing of the outlook and a lessening of efficiency. In commercial life wide knowledge is equally essential to individual and

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national prosperity. The mistakes of the past—the whole history of the dye trade is only one of many glaring examples—are mistakes for which commercial men must share the blame with the politicians. New problems which can only be solved by those possessing that power of foresight which depends on wide, well-digested knowledge are continually arising and the old problems are perpetually requiring fresh solution.

Knowledge of this essential sort is lacking largely because it is not available in a form that can easily be appreciated by those without expert training in the individual trades. Yet the knowledge is vital to all those who have the interests of the nation at heart. Events have shown that the public dare not remain in ignorance. It is the duty of the individual citizen to realise the factors on which the prosperity of the country depends, to have exact knowledge as to the sources both of the raw materials and of the manufactured products that enter so largely into the life of the nation.

It is the purpose of the present series to supply this want. Each volume in it is the work of an expert, and in every case care is being taken to give an exact but general view of the staple trades as a whole. It is hoped that the information so presented will be of value to those who may be

brought actively into contact with the industries concerned, that they will enable the nation as a whole to form a sound judgment on questions of commercial importance.

GORDON D. KNOX.

AUTHOR'S PREFACE

Books on wool and the wool industry are many and of great value, but generally they are of sectional interest only, and incapable of being appreciated by any but those possessed of special technical knowledge. The present volume is intended to make a wider appeal, and, while maintaining strict scientific accuracy, to present a comprehensive survey of the subject in a more or less popular form. In other words, the object of the writer has been to bring together material upon which the general reader may form a sound opinion without being worried by detail and perplexed by technicality.

It is hoped, also, that the student will find much to interest, especially in those chapters which deal with the introduction of the wool trade into Great Britain—a phase of the subject which has hitherto hardly had the attention it deserved.

The writer has to tender thanks to the various authorities quoted in the following pages, and especially to the officials of the Commonwealth

and States of Australia, to whom he is indebted for much statistical and other information, and also for some of the most attractive pictures in the book.

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UNIV. OF CALIFORNIA

WOOL

CHAPTER I

THE GENESIS OF WOOL

THE industry of Wool is undoubtedly the oldest known to the round world. By this, of course, is meant the growth rather than the manufacture of the fibre, for wool remained purely domestic in use for ages before it figured as a marketable commodity.

Many people—on the principle that the hen must of necessity have existed before the egg—have contended that priority should be given to Agriculture, but probability and recorded history are altogether against such a theory. Prehistoric man, we are led to believe, lived solely by his prowess as a hunter, but at the dawn of civilisation we find our less hairy ancestor laying aside his club and spear and taking up the shepherd's crook—indeed, exchanging his cave dwelling for a nomadic life in which sheep invariably figured and provided him with a means of sustenance. The more careful arts of husbandry belong to a later date.

In "the days that were earlier" man's immediate wants were without doubt supplied almost entirely by members of that mild and faithful ovis family which had, no one knows how or when, appeared on the scene to provide him with food for his maintenance and a warm covering against the stormy elements, and that without imposing upon him the hardship of tilling the soil, or calling for any special care whatever. All that the keeping of sheep involved in that far-off day was the exercise of a guiding and protecting hand—a shield from prowling beasts of prey, and liberty to roam where green pastures invited and limpid streams abounded.

It may be safely assumed, then, that men were pastoralists long before they were agriculturists, and, therefore, that the gentle shepherd of song and story embodies for us the first idea of organised industry in the history of the world. The main business of our early ancestors was to wander to and fro on the face of the earth feeding and watering their sheep, and giving no thought whatever to the tilling of the soil. Just at what period man began to live a more settled life it is difficult to tell—when he began to sow his corn and call for a raiment more comfortable and presentable than his rude sheepskin; but that the date is very remote can be gathered from the fact

that we must go back to a time long anterior to the civilisations not only of Greece and Rome, but of Carthage and Babylon and even ancient Egypt itself.

The Bible, as well as pagan literature, is full of allusions to sheep and shepherds, and there is also abundant evidence, both in Holy Writ and in the classics, that the ancients were familiar with the methods of manufacturing and dyeing wool. Probably wool was "felted" long before it was spun and woven, for we have Pliny pointing out that garments can be made without the aid of spinning and weaving, and also stating his belief that if vinegar be used in the felting, the garment can be made proof against both fire and sword! To show, however, that weaving is a very ancient branch of industry, we need only quote the words of Job, who lamented that his days were "swifter than a weaver's shuttle," while the frequent mention of people being clothed in purple and other colours proves that dyes were well known at a very early period of the world's history. Herodotus, too, makes it quite clear that woollen was one of the earliest of our commodities. Speaking of the proficiency of the Egyptians in making fine linen—and with all our experience and mechanical aids we have not appreciably out-distanced in quality the linen product of that far-off day—

he states that it was accounted profane to enter any temple wearing a woollen garment, or to be buried in anything made of wool. It is a curious fact, worth mentioning, that history quite reversed this dictum many centuries later, when Charles II. commanded that all and sundry should be buried in woollen. In the case of the Stuart there was a hard commercial reason behind the order, and maybe if we could get down to the controlling influences of those Egyptian times we should find a somewhat similar reason. It might not have been so much a matter of profanation that was involved, as a special "pull" which the linen manufacturer of that day had acquired over the maker of woollens.

It would be difficult, perhaps, to determine exactly which is entitled to historic precedence—silk, or flax, or wool; but it can be said with something like certainty that wool was the first of the textiles to be used to any extent for the clothing of Europeans. We have ample evidence of its popularity with the Romans, and we have good reason for believing that it was the Roman who introduced the methods of manufacturing woollen into England. Cæsar records that at the time of his invasion the Britons of the interior were for the most part clad in skins, but he adds that the inhabitants of what is now Kent were much more

civilised, and did not greatly differ from the Gauls. Many wore drapery similar to that of the Gallic and the Belgic tribes, he says, and they presumably imported the cloth from the Continent. Whether the clothing was or was not made in Britain we are not definitely informed, but we have it on record that the Romans brought the manufacture of wool to England along with other arts of peace. The sheep is stated to have been a domestic animal in Britain long before the period of the Roman occupation, but it was the Romans who first taught the natives what possibilities there were in the fleeces. Camden states that the Romans established a large factory at Winchester for the production of clothing for their troops, but the industry thus started was practically wiped out again when the barbarous Saxons overran the country after the departure of the Roman hosts. It was not until William of Normandy reached our shores that the wool industry came to life again, and it was a good deal later that the impetus was given to it that was eventually to make Britain the foremost manufacturing country in the world.

The part the Golden Fleece has played in English history is a royal one, but it is apt to be forgotten in a day when few people stop to think why the Lord Chancellor takes his seat upon a

woolsack, and when the man in the street would have difficulty not only in naming off-hand the benefactors who first introduced the comfort of woollen into Britain, but even in specifying that "Royal Wool Merchant" who provided us with the technical knowledge necessary to become a great manufacturing nation. An obscure paragraph in a morning newspaper records now and then that so many thousands of bales of wool have been bought and sold somewhere in the great city of London, but seldom is a thought spared on what lies before and behind the bald announcement. It is a paragraph from which all the "picture" is excluded, and the reader is not encouraged to think either of the lands where millions of shaggy-coated sheep are being reared under the eye of careful flockmasters, or of the astonishing ingenuity that is daily being exercised in the great factory areas of the North to furnish a covering sufficient for health and comfort, and at the same time to provide that fine raiment which inexorable Fashion has decreed is almost as indispensable for personal adornment.

Before the thirteenth century the historical records of this country were not a great deal concerned with either sheep or wool. True, we are sometimes told what was the ruling price of the sheep—at one time it is said to be a shilling, and

at another to have fallen as low as a penny—and we occasionally hear of "fines for leave to export wool," but it is not until the time of the Second and Third Henrys that reports on wool and woollen become common.

We are told with certainty that Henry III. visited Witney in 1221 and "expended £20 on his wardrobe," and that in 1300 woollen guilds were established in London, Norwich, and other places. The first of these guilds was for weavers and burrellers, the second was for dyers and fullers, and the third for tailors. This seems to be proof positive that the trade was well established in England seven or eight centuries ago, especially, too, as we find that a weaver of Bristol, by name Thomas Blanket, invented so early as 1320 the raised woollen material which still bears his name. A little later (1341) Norfolk, one of the special places where the weavers had settled, was stated on the strength of its assessment to be "the wealthiest county in England next to Middlesex," and nine years after this it was computed that England had an annual export of eleven and a half million pounds of wool, the value of which was £180,000.

As evidence that the wool industry very early settled in the North, we have it on record that a fulling mill was founded in Bradford, and another

at Colne in Lancashire, during the reign of Edward II., implying clearly (as Dr. Whitaker points out in his "History of Whalley") that cloth was manufactured there early in the fourteenth century, and plainly contradicting the generally received opinion that English wool was universally manufactured in Flanders till the Act of the tenth of Edward the Third inviting over Flemish manufacturers and granting them considerable privileges. There are said to have been fifty families invited over, and these, in return for substantial advantages, were to teach the natives of this country the arts of spinning, weaving, and dyeing wool. One of these manufacturers from Flanders was a distinguished person named John Kempe, who brought improved methods of making woollen cloth and settled in Westmoreland, at Kendal. He is said to have founded the popular "Kendal green" spoken of by Shakespeare.

Fuller, the historian, alluding to the time of this early settlement of Flemings, makes the following quaint comment: "The king and state began now to grow sensible of the great gain the Netherlands got by our English wooll. In memory whereof, the Duke of Burgundy, not long after, instituted the order of the Golden Fleece, wherein, indeed, the fleece was ours, the golden their's, so vast their emolument from the trade of cloth-

ing. Our king therefore resolved, if possible, to revive the trade of his own country, who as yet were ignorant of that art, as knowing no more what to do with their wooll than the sheep that weare it, as to any artificial and curious drapery, their best cloth then being no better than freeze, such their coarseness for want of skill in their making. But soon after followed a great alteration."

It was, indeed, a great alteration which followed, so much so, in fact, that wool, in its raw and manufactured states, became the most important source of wealth in the country, and remained so until the end of the eighteenth century, when cotton made such extraordinary strides in England. It was in those early days described as "the flower and strength and revenue and blood of England." All kinds of laws were enacted to protect and stimulate it, some threatening even life itself. One of the best known of these legal expedients—one which has already been alluded to—was that of Charles II., who decreed that all dead bodies should be buried in woollen shrouds. This enactment remained in being for over a hundred years although it has to be admitted that it ceased to be regarded long before it was removed from the Statute Book.

CHAPTER II

THE COMING OF THE WEAVERS

THE coming of the weavers is one of the most interesting chapters in our industrial history. How the first Flemish people were lured into the country in Edward's days we cannot quite tell. There must have been some very special inducement to attract such home-staying people—something more, one would imagine, than the baits said to have been held out by the historian Fuller. That old chronicler states that the emissaries employed by the king ingratiated themselves with the journeymen and apprentices rather than the masters, and began to instil a spirit of discontent by pointing out that they were worked rather like heathens than Christians, and like horses rather than men. Why not then leave their long hours and heartless masters? why not give up their herrings and mouldy cheese and come to a land where they could feed upon fat beef and mutton—feed until nothing but their fulness should stint their stomachs! Besides, wasn't England the country of the most beautiful

women, and were not the richest yeomen waiting to marry their daughters to them? The blandishments may or may not have had some effect, but, judging from the manner in which the people of the Low Countries usually conducted their business, one would imagine that something in the way of good hard cash would have to be forthcoming, as well, before the cautious burghers picked up their traps and sailed away.

All this, of course, refers to what may be termed the first invasion. The coming of the second and much larger contingent in the sixteenth century was due to a totally different set of circumstances, and then the Netherlanders needed no feminine charms nor promises of stuffed paunches to attract them to the shores of Britain. They came with alacrity and on their own initiative, glad to escape to any haven of refuge. The textile trade of Britain received its greatest impetus while the infamous Duke of Alva was, as Froude puts it, engaged in "drowning heresy in its own blood" in the Netherlands. Previous to that, manufacture had been carried on in a more or less desultory fashion; in the latter half of the sixteenth century circumstances conspired to make England industrially great at the expense of a gifted but terribly unfortunate people.

Spain, at the beginning of the second half of the

sixteenth century, it will be remembered, was the great world-power, controlling the destinies of the Netherlands, of Germany, of a great part of Italy, of Sicily, as well as settlements in Africa and the New World. The Netherlands at that time were enjoying a period of the greatest prosperity. An industrious people, with a special aptitude for manufacturing, they had wrested the commercial supremacy from Venice. Trade flourished and wealth abounded. The people, laborious, diligent and ingenious, lived in opulence and comfort, and desired nothing so much as to be allowed to live in peace and develop their industries. Philip II., however, had come to the Spanish throne, and was ambitious of converting the whole of Europe to Catholicism. One of his greatest obstacles, he found, was that the Netherlands had begun to imbibe too freely the reformed religious doctrines of the times, and he set himself with great zeal and energy to stamp out heresy and crush Protestantism throughout the provinces. The Netherlanders, seeing their liberties threatened, vehemently protested, but Philip replied by instituting an Inquisition which had results of the most terrible and far-reaching character. The history of that murderous oppression reads to-day like a nightmare. The spirit of religious frenzy which then reigned can

with difficulty be comprehended in our colder and more rational age. Before the tyranny was overpast it was difficult to find a fireside, Protestant or Catholic, which had not been made desolate by execution, banishment, or confiscation. Alva was Philip's zealous emissary, and long before he had finished his appalling task a multitude of the most able and industrious of the Dutch and Flemish people were wandering penniless in distant lands. Foreign merchants were scared from the great commercial cities, and every industrious artisan who could find the means of escape sought refuge among strangers, wherever an asylum could be found.

That asylum was chiefly found in Protestant England, who received these intelligent and unfortunate wanderers with cordiality, and drank in with eagerness the lessons in mechanical skill they had to teach. Already it was estimated that there were thirty thousand emigrant Netherlanders established in Sandwich, Norwich, and other places assigned to them by Elizabeth, and the refugees added thousands more to England's population. Later on, it may be incidentally mentioned, other religious persecutions brought refugees to our shores, notably after the Massacre of St. Bartholomew in 1572, and the Revocation of the Edict of Nantes in 1685. These men,

however, were French, principally silk weavers and makers of brocades and paduasoys, and relics of the prosperous era of industry they inaugurated in Kent, which did not die until the middle of the eighteenth century, are yet to be found in many place and family names, in buildings, even in a remarkably distinct physical type, especially near Rye and Winchelsea, and above all in the existence of the Huguenot church in the crypt of Canterbury Cathedral. The peaceful invasions of the earlier "Dutchmen," as the Netherlanders were generally and indiscriminately named by the mass of the people of this country, have left their own special evidences in other parts of the country, both North and South. There are to-day, for instance, plenty of reminders in such old-world Kentish towns as Cranbrook, Tenterden, Hawkhurst, Smarden, and Biddenden of a very large and flourishing woollen industry, and local records are full of evidence that the Kentish "grey-coats" were not only popular locally, but were appreciated to the full in other parts of the country.

In connection with these two main invasions of Netherlanders mention may be made of two important decisions which vitally affected the woollen industry in this country, and demonstrated, moreover, how closely in the early days the British kept their eyes fastened on the main chance.

England, it will be remembered, was for centuries a grower of wool before she was a manufacturer of it; at least, before she was a manufacturer of anything beyond her bare domestic needs. In the first half of the fourteenth century England was very largely exporting the product of her sheep, and, after manufacture in the Low Countries, the cloth was brought back again to be made up into clothing. Edward III.'s queen, Philippa, herself a Netherlands woman, is always given the credit of making what would seem, in the circumstances, to be a fairly obvious suggestion—the suggestion that Mahomet should be brought to the mountain, and not the mountain taken to Mahomet. In other words the queen asked why the wool could not be manufactured as well as grown in England, and so do away with the trouble, cost, inconvenience, and often the very great loss attached to sending cargoes of wool across the boisterous North Sea where dangers in those times abounded. The king, curiously enough, seems not to have thought of such an accommodating plan, but the moment it was suggested to him he acted upon it with alacrity. Indeed, so devoted did he become to the work of developing the wool trade in England from that time onward that he came to be known as its special patron, and to this day the woolsack in the House of

Lords, as well as a number of interesting statutes, remains as a monument to his zeal and enterprise.

The other important step taken to advance the native industry was contemporaneous with the settlement of the refugees in England at the time Alva was engaged in his terrible crusade. One condition imposed upon the settlers from the Continent was that they must not keep their precious textile secrets too jealously guarded. It was accordingly enacted that each of these weavers should take at least one English youth into apprenticeship, while at the same time the tariffs were adjusted so that England might obtain a maximum of advantage. This system of apprenticeship, it need hardly be said, was the opening of the door to native enterprise, and how readily and capably the opportunity was grasped is to be read in the astonishingly rapid growth of the British textile trade. The system of apprenticeship remained in force long after the "Dutch" had either been assimilated in the land of their adoption or had returned to their native shores, after Alva had ceased from troubling and their sorely-tried country was at rest.

Smiles tells us many interesting things about the settlement of the Flemish weavers in this country. Although the English at a later date

showed some animosity against the refugees who so rapidly waxed fat in England, there is no doubt that at the outset they were very heartily welcomed, Elizabeth herself enjoining the Mayors of Deal, Sandwich, and other places to give the foreigners full liberty, as their coming was calculated greatly to benefit the towns by "plantynge in the same men of knowledge in sundry handycrafts in which they are very skilful." From about 1561 onwards the fugitives came from Flanders in a steady stream, and by 1573, when Queen Elizabeth visited Sandwich, the Flemish constituted about one-third of the entire population of the town. On the occasion of the royal visit referred to, it is recorded that "against the school-house upon the new turfed wall, and upon a scaffold made upon the wall of the school-house yard, were divers children, to the number of a hundred or six score, all spinning of fine bag yarn, a thing well liked both of Her Majesty and of the Nobility and Ladies."

Norwich was one of the chief settlements of the Flemings, there being at one time between four and five thousand domiciled there. These refugees brought great prosperity to the place, but when the foreign artisans had prospered, the natives of the city were among the first to turn upon their benefactors. The local guilds passed

stringent regulations against the weavers, who were eventually driven out of the place. Many left Norwich for Leeds and Wakefield, in Yorkshire, where they prosecuted the woollen manufacture free from the restrictions of the trades unions of that day; while others left England for Holland, to carry on their trades in the free towns of that country.

The Flemish also spread themselves through the towns and villages in the West of England, as well as throughout the North, and wherever the woollen weavers set up their looms they carried on a prosperous trade. In the North they established themselves at Manchester, Bolton, and Halifax, where they made "coatings," or "cottons," which were at that day imitations in woollen of the goods known on the Continent by those names, the importation of the vegetable cotton fibre from the Levant having only begun, even in small quantities, by about the middle of the seventeenth century.

"There is one fact," says the editor of the "Shuttleworth Papers," "which seems to show that the Flemings, after their immigration, had much to do with the fulling mill at Manchester; for its ordinary name was the 'walken-milne'—*walche* being the Flemish name for fulling mill. So persistent do we find this name, that a plot of

land occupied by a mill on the banks of the Irk still retains its old name of the Walker's Croft (*i. e.*, the fuller's field or ground), and in the earlier Manchester directories, the fullers were styled 'walkers.'" The name of Walker, so common in Yorkshire, Lancashire, and the clothing districts of the West of England, doubtless originated in this calling, which was followed by so considerable a proportion of the population. It might also be added that many old people in rural districts in the North still allude to fulling mills as walk mills, and constantly speak of fullers' earth as "walkers' earth" (or "yearth," as the last word is more commonly pronounced in the dialect).

Fuller, the historian, specifies the following textile manufactures as having been established by the Flemings in various parts of the country: in Norwich, cloths, fustians, &c.; Sudbury, baizes; Colchester, sayes and serges; Kent, Kentish broadcloths; Devonshire, kerseys; Gloucestershire and Worcestershire, cloths; Wales, Welsh friezes; Westmoreland, Kendal cloth; Lancashire, coatings or cottons; Yorkshire, Halifax cloths; Somerset, Taunton serges; Hants, Berks, and Sussex, cloth. Kendal, it may be added, was also noted for the manufacture of cloth caps and the long woollen stockings which went with the knee breeches of the period.

The refugees, of course, brought other trades to England besides weaving, London, especially, being enriched by the new industries. They were, for instance, famous for their horticulture, and are said to have started the gardens still to be found at Wandsworth and other places on the outskirts of London, while their cultivation of the hop plant, which the Walloons brought with them, led to the making of the old distich—

"Hops, Reformation, Bays and Beer,
Came into England all in one year."

The rise of other trades and industries are foreign to the present purpose, and it is sufficient to say that through the apprenticeship system imposed upon the refugees the native population of England gradually learned to practise the same branches of manufacture as the immigrant wool-workers, and to build up a great and profitable trade for themselves.

"The ribs of all people throughout the world," wrote Matthew Paris, "are kept warm by the fleeces of English wool," and at a later day it was possible not only to make a boast of having supplied the wool in its raw state, but of having as well a monopoly of the world's exports of the fully-manufactured article.

CHAPTER III

HOW ENGLAND TOOK THE LEAD

CHANCING to look in at the open door of a bleaching works in the North recently, I was surprised to see lying on the bench a couple of pairs of sabots in every way identical with those worn by the peasantry in France, Holland, Belgium, and other western countries of continental Europe. To the lad at work near at hand these clumsy wooden shoes were nothing more than "Dutch clogs" used occasionally by the workmen in place of their own iron-shod footgear to obviate damage to the cloth they were called upon to load and unload, but, had the boy known it, they were admirably calculated to light up and link up the whole of England's industrial history. In a flash the mind was carried back over seven centuries, to the times when those ingenious, peace-loving exiles first set foot in feudal England, and then to a still later day when England, improving upon the work of her benefactors, laid the foundation of our textile industries on a sure and lasting basis. But though they were long ago beaten in

the race, it says much for the pertinacity and enterprise of those early settlers that their wooden shoes are heard clattering down the centuries, and that the trades they established in the land of their adoption are now among the greatest industries in the world. Here and there a Flemish name, too, lingers to link up the present with the past, but beyond this, and the insistent evidence of the clog, there is hardly anything left to mark the peaceful invasion of a former day. The industry of wool has taken upon itself an entirely modern aspect, and its romance is now distinctly of the Kiplingesque variety. The picture of Evangeline beside her wheel has gone, and the handloom only remains as a frame upon which the up-to-date designer works out a complicated pattern in power-spun yarns.

Natural advantages, coupled with the special genius of the people, no doubt accounts for subsequent British supremacy, and more especially for the great bulk of the woollen trade finding its way to the district north of the Trent. The first immigrants, it is well to remember, knew nothing of cotton; they were all woollen spinners, weavers, and finishers, who would require fulling mills and an abundance of water. Where, then, would they be likely to get ideal conditions for turning their waterwheels and scouring the products of their

looms? Where better than in the cloughs and dells bordering upon the hills which make up the Pennine Chain? The Norfolk Broads, no doubt, supplied more or less adequately the early wants of the Flemings, but nowhere in the country were the natural conditions so propitious as among the hills and dales of Yorkshire and Lancashire. In the small valleys of the Pennines to-day can be found ruins of fulling mills which by their age may have done duty for the very people with whom we are now dealing. We all know, too, that the suitability of the northern climate for both spinning and weaving is unrivalled in any part of the country, and this, of course, would act as an extra inducement to settlement north of the Trent.

This matter of climatic fitness is, indeed, worthy of special note. We know, of course, that it has become almost second nature to abuse everything connected with our damp and clammy atmosphere, and yet Englishmen, on reflection, ought rather to be paying daily tributes to the water deity. There is scarcely anything in which we excel which is not due either to the dampness of our climate or the virtues of our water-brooks. It is the water that makes Burton famous for its ale, that gives Sheffield an advantage in tempering steel, and obtains for certain parts of Ireland and Scot-

land supremacy in finishing linen fabrics; the humidity of the climate in the country lying near the Pennine range of hills has helped to make textile manufacturing in Lancashire and Yorkshire what it is. Germany at one time imported Sheffield water in hogsheads in order to produce, if possible, the best class of cutlery, and similarly to-day we find the American textile manufacturer calling to his aid the artificial humidifier, which, as every factory operative knows, cannot in any way compete with our own moist climate in keeping ends together and weaving "good."

If we are to believe that the exceptional water facilities of the North had a great deal to do with the settlement of the Netherlanders in the first instance, we may conclude that the discovery of coal at a later stage would be responsible for their final adoption of the North as a place of habitation. Mr. Neil Munro, in one of his historical novels, speaks of the almost insuperable obstacles which were placed in the way of the Lowland "tradesmen" who were imported into the Highlands by one of the Dukes of Argyll—how they were driven and harassed by the unruly clansmen amongst whom they had settled, and how their very peaceableness was an offence in the eyes of men whose lives were chiefly devoted to marauding and fighting. No doubt the Flemish were

made to suffer in a similar way when they first settled in the North of England; indeed, it is on record that robbers and freebooters harried them so persistently that the king, unable to give them adequate protection in the wild North, moved them to the West of England, where they laid the foundations of the broad-cloth manufacture for which that part of the country was for so long famous.

Macaulay states that the lawless manners of the people on the Scottish border had originally much to do with the difficulties of settlement in the North, the disturbances being not confined to the border line between the two countries, but spreading for many miles south of the Tweed. "Slowly and with difficulty," he says, "peace was established on the border. In the train of peace came industry and all the arts of life. Meanwhile, it was discovered that the regions north of the Trent possessed in their coal beds a source of wealth far more precious than the gold mines of Peru. It was found that in the neighbourhood of these beds almost every manufacture might be most profitably carried on. A constant stream of emigrants began to roll northward." It therefore seems likely that, once the Netherlanders had settled as far north as Lancashire and Yorkshire, they would be retained there when coalfields began

to be developed and the introduction of steam caused the industry to become more profitable than ever for both master and man.

In the early days practically every county in the three kingdoms did hand-spinning and weaving as an adjunct to the industry of agriculture, but gradually it happened that more attention was paid to the trade in those parts where the returns from agricultural pursuits were poorer. It was noticed in the sixteenth century that the trade in Yorkshire woollens was most actively engaged in "where the fertilitie of ground ys not apt to bring forth any corne nor good grasse," and Defoe in his tour through the country in 1722 also states that these auxiliary industries were to be found flourishing best in those parts where the land was poor, notably in the more barren places in and near the Pennine slopes. The houses on the Yorkshire side particularly were, he said, "full of lusty Fellows, some at the Dye-vat, some at the Loom, others dressing the Cloth; the Women and Children carding or spinning; all employed from the youngest to the oldest; scarce anything above four years old, but its hands were sufficient for its own support. Not a beggar to be seen, not an idle Person, except here and there in an Alms-house, built for those that are ancient and past working."

Indeed, anywhere in the North country in those days one might be almost sure to find that where a man had a few acres of ground and a small farm there would be in his house a place for three or four looms, and there the art which had been learned from the Flemings would be carried on by members of the family, aided, perhaps, by one or two apprentices.

It was in these communities, larger and keener than in parts of the country where life was taken more easily, that specialisation and co-operation began to tell, and where curious and ingenious minds began to seek out means for so improving machinery as to give them distinct advantages over their competitors. As we have seen, the climate did much, but dogged determination and untiring energy did even more. Almost imperceptibly the industry changed. Shrewd heads began to see that there was more money in the manufacture of woollen "pieces" than in trying to till land which would produce "scarce enough corn to feed their cocks and hens," and the wealthier among them gradually developed into employers of their less fortunate neighbours, and began to establish a regular and more substantial trade with the merchant class.

Almost every cottager came to have his "loom-house," and there was in the North in the seven-

teenth and eighteenth centuries no more familiar figure than the old hand-loom weaver in his blue apron, standing at odd moments at his doorway smoking his long clay pipe, or perhaps trudging along the country roads, under the weight of his heavy pack of cloth, on his way to the house of his employer. The small master furnished these domestic weavers with yarn to be woven in their cottages, receiving back from them the cloth to be dyed and finished, after which it was sold to the big clothiers who lived in the large industrial centres.

Still, things went on in a rather jog-trot way for a long time, and it was not until cotton began to loom large on the industrial horizon that woollen manufacturers were enabled to take a great bound forward. The men who did so much for the Yorkshire trade in the early days were, curiously enough, mostly Lancashire men, some of whom were actually engaged in developing the newer industry. John Kay, of Bury, the first of the big inventors, however, may be said to have been a woollen man pure and simple, for it was to the problem of throwing the shuttle across the broad woollen loom that he so successfully addressed himself. By Kay's invention the production of the hand-loom was vastly increased. Before his time no man could weave a wide piece except

very slowly and with the most primitive appliances. The shuttle was attached to something like a long skewer, which had to be passed on from hand to hand. When wide goods, such as sheeting, were being made, it actually took two men to hand the shuttle along and work the beam as well. This antiquated method, of course, meant that as both hands were occupied with the shuttle the reed could only be advanced to beat up the weft while the shuttle was at rest at one end of the loom. Kay introduced a "picker" or thrower to the shuttle, which could be worked by one hand and left the other free to work the reed, thus greatly increasing the speed at which the weaver could work. It was undoubtedly a great step forward, and there is no question that the invention placed this country in the front rank in the world's markets for textile manufactures.

As Kay's invention quadrupled the productive power of the weaver, there was naturally a much greater demand for weft, and this started another Lancashire man—James Hargreaves, of Blackburn—on the search for a means of increasing the output of the spinning wheel. The story goes that the idea of the spinning jenny was revealed to him through his wife, who was named Jenny, accidentally overturning a Saxony wheel, and

disclosing to him how a spindle, placed vertically, might be made to work on a manifold system. The result of his efforts, with small means and the most primitive tools, was that he at length succeeded in making a hand-frame which enabled eight threads instead of one to be spun, and, with this invention as a basis, Richard Arkwright, of Preston, and Samuel Crompton, of Bolton, later on made spinning frames which would spin not only weft, but warp as well, and that at a vastly higher rate of speed, while Crompton also made it possible to spin the finest material on the largest frames, a problem which for a long time seemed well-nigh impossible of solution. Later again, when spinning had had its turn, Edmund Cartwright, of Marnham, in Nottinghamshire, took up the loom practically where Kay and his son had left it, and after much trouble and opposition made weaving by steam-power practicable.

Meanwhile, Yorkshire was turning its attention to the improvement of some of the earlier processes of worsted manufacture, and especially to the problem of combing wool by mechanical means. In this connection there is one name particularly deserving of mention, belonging as it does to one who is worthy to rank with the master minds who first revolutionised the textile trade not only of this country, but of the whole world. It is the

name of Samuel Cunliffe Lister (afterwards Lord Masham), who did no little to raise Bradford to its dominating position in the woollen trade of the world.

Lister was born in the famous year of 1815, and by the time he was old enough to enter business trade was in a state of rapid expansion, presenting splendid opportunities to men of inventive skill and business aptitude. When he and his brother commenced business as manufacturers of worsted stuffs, the power-loom had only been invented by Dr. Cartwright some ten years, but spinning and weaving had arrived at a comparatively efficient stage. Hand-labour, however, still prevailed in the earlier stages of the preparation of wool, and rich rewards awaited the solution of the problem of how to comb wool by machinery subsequent to the wool being washed and dried. Some measure of success had already been achieved by Cartwright, Donisthorpe, and others in dealing with the coarser wools, but it still remained impossible to treat by mechanical means the finer qualities which go to the manufacture of the best kinds of worsteds. Lister and Donisthorpe, in this country, and Heilmann, of Alsace, arrived almost simultaneously upon the solution of the problem, but Lister, through purchasing Heilmann's English patent rights and improving the

machine almost out of recognition, held for many years a practical monopoly of the wool-combing industry. It was at Manningham Mills, in Bradford, that fine, or botany, wool was first combed by machinery, and so great was the success of Lister's wool-comber that spinning firms were glad to buy the machines and pay him a royalty of a thousand pounds on each.

It was by such inventions as these, aided by the introduction of the factory system, that the manufacturers of Yorkshire and Lancashire were able to out-distance all competitors. It was facility rather than superiority of production which won in a day when the world was crying out to be more cheaply clothed; and, despite the progress in machinery, even to-day the best and most durable woollen materials are made by hand.

It is not necessary here to do more than mention the troubles which have marked almost every step in the progress of woollen manufacture. The early textile workers exhibited the same opposition to machinery that was shown in later years, and as long ago as 1482 a petition was presented to those in authority against the use of fulling mills. Among many obstacles put in the way of developing trade may be mentioned the onslaught made upon John Kay, the man who first speeded up the hand-loom by means of the "picking-stick." Kay

not only had his invention pirated, but in 1753 his house at Bury was broken into and sacked by a mob of operatives jealous of innovations which they believed threatened their livelihood, and he barely escaped with his life. As a consequence, he migrated to France, and there died in poverty and obscurity. Other inventors who succeeded him were persecuted in a similar way, and the whole history of the rise of the industry is punctuated with riots of a more or less serious nature, both before and after the introduction of machinery driven by steam-power. Bradford, being the centre of the wool trade, has always been a stormy district, and strikes, some attended with great violence, have been frequent. Perhaps in recent years the wool-combing section has been more involved in quarrels between master and man than any other, for, apart from the labour-saving devices introduced into wool-combing, there have always been difficulties with regard to the irregularity of the hours and the casual character of the employment.

CHAPTER IV

SHEEP AND THE WOOL FIBRE

SHEEP have always been more or less of a puzzle to naturalists owing to the difficulty they present in the matter of origin and classification. It is not very helpful, perhaps, to speak of them as "a genus of ruminant quadrupeds of the family Capridæ, so nearly allied to goats that the propriety of generic distinction is very doubtful"; it would be much more interesting if we could say with more exactitude from which of the wild species the domesticated animal has sprung, and what country or race first discovered and developed it. All we know is that its origin is lost in antiquity, and that it seems to have been "tended" (and consequently domesticated) long before history was recorded. While it is supposed by some that all the wild sheep existing in the world are mere varieties of one species, that species cannot be identified, nor can it be said from which of these branches the domestic sheep is to be traced. We are perhaps on safe ground when we say that the sheep was the first animal

domesticated by man, as the weaving or felting of wool was among the earliest of the arts. What we do know, also, is that wild sheep have but a scanty supply of short wool, with an outer covering of hair, and that the more the sheep is brought into cultivation the shorter and scarcer the hair and the greater the yield of pure and good wool.

It must, from the very earliest times, however, have been an animal much prized by man, for not only do we find its fleece and its flesh greatly esteemed, but dead and alive it can be put to many excellent uses. Its milk, though somewhat strongly flavoured, has always been sought after in Oriental countries; it has been found particularly useful as a beast of burden in hilly and rocky country in India and elsewhere; and in more modern times its skin has been tanned into leather and used extensively for bookbinding and the making of gloves. Indeed, the carcase of a sheep can nowadays be used almost as economically as that of the pig.

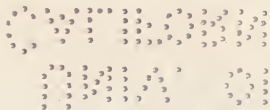
The sheep has many characteristics peculiar to itself, and many which are contrary to those which govern other animals. For instance, most animals intended for human food will have their flesh greatly improved in flavour by feeding on rich foods or in lush pastures; but the sheep shows a decided preference for bare living, and the

mutton produced on the short, scanty grass of upland places is generally of better quality than that of the sheep pastured on richer lands. It is contrary in other respects—its stupidity in blindly following the leader of the flock has made its "silliness" proverbial among country people; but a shepherd will tell you that it is by no means so devoid of intelligence as casual observance supposes. Neither do the folk sayings which cluster round the sheep argue great wisdom on the part of those who tend the flocks. What foundation, for instance, can there be for the contention that "Leap year is never a good sheep year"? Surely an added day to the calendar cannot prejudice either sheep or man very greatly, and the saying must have originated with one whose rhyme was vastly superior to his reason.

The breeds of sheep are as numerous as they are varied. Apart altogether from the many kinds of wild mountain sheep, which must be countless in number, the domesticated animals are bewildering in their quantity and variety. Nearly every nation on the face of the globe boasts flocks of one kind or another, the types differing in every climate and every latitude. All sorts and conditions of fleeces are to be found in which wool and hair are present in varying quantities, but for present purposes we must confine ourselves to a

A GROUP OF LINCOLNS, THE FAMOUS ENGLISH LONG-WOOLLED SHEEP

(Photo by Mr. George A. Champion, by Courtesy of "Farm and Home")



survey of those animals which produce wool that can be most easily used for manufacturing purposes. The rougher of these wools, which often contain much hair, are chiefly used for carpet-making, and the purer wools are made into clothing. Carpets are an Eastern institution, and the sheep which provide them are, speaking generally, Oriental in origin; but the clothing wools are essentially European, or were in the beginning. Greece and Rome made good use of their flocks, and England can boast of having raised sheep from a very early age. English wool was for long sought after by Continental manufacturers, and down to this day she has maintained her great flocks; but if she cannot herself now boast a superiority in numbers, she is aware that within the British Empire are more sheep than in all the other parts of the world put together.

Some account is given in other chapters in this volume of the circumstances which led to the development of the sheep industry in Australia and other countries from an original stock of Spanish sheep of merino breed, and at the same time a brief survey is taken of the numbers and breeds to be found in various parts of the globe. Outside the all-conquering merino strain, however, it will be found that Britain has directly or indirectly supplied the foundations of most of the

world's flocks. The British Isles, indeed, may be said to epitomise the whole sheep populations of the two hemispheres, for there are few varieties of domestic sheep outside the merino which have not had their origin in Great Britain.

The question as to which was the original type in Great Britain is a little difficult to answer, but perhaps the black-faced variety to be found in the North of England and in Scotland is as near to the original as any breed now existing. They are a hardy, horned breed with good mutton qualities, but the wool, although valuable, is not of the best class that England can produce. The Welsh and the Cheviot breeds are the next higher in scale, the fleece of the latter, which are found in many parts of England as well as in the Cheviot district, being very highly esteemed. The Welsh sheep are prized more particularly for their mutton qualities. The Leicester is one of the most valuable of the native breeds. Formerly, the sheep of that name was big, but coarse; but about the middle of the eighteenth century its development was taken in hand, and the New Leicester, as it was afterwards called, became known as an animal of excellent shape and capable of producing the best of wool. It also had the quality of being easily fattened. Of late years it has been largely used for crossing with other breeds, and some

fine long-woolled sheep have been the result. The most notable successes have been crosses with Lincolns, Romney Marsh, and others. The Leicester, indeed, may be said to have done more for the improvement of British stock than any other breed. The Lincoln, a cross between the improved Leicester and the native sheep of the county, is another excellent long-woolled sheep—one of the best that England produces. The wool, besides being long, is lustrous, and the fleece is often of remarkable weight. The Cotswolds are also famous long-woolled sheep, and were highly prized as long ago as the fourteenth and fifteenth centuries. At one time their wool commanded higher prices than any other. The Southdown has of late years been improved with the utmost care, with the result that it now produces splendid short, curled wool. There are a host of other fine sheep—the Shropshire, with a good thick wool something like the Southdown, the long-woolled Devon, the popular Romney Marsh, the Suffolk, the Wensleydale, and many valuable Scottish breeds. The Roscommon is the principal breed in Ireland, being a native variety improved by crossing with the Leicester.

Turning from sheep to the wool fibre, it may be said that hair and wool, so closely allied, are of

Nature's own choosing for the protection of the brute beasts; and man, so far, has found nothing comparable with them as shields against the cold and stormy elements. In the more northerly climates wool is indispensable, and pure wool is of inestimable benefit in climates which are considered much more genial than our own. Even in tropical and sub-tropical countries there are, at certain times of the year, great extremes in temperature in the space of twenty-four hours, and the value of good woollen, with its slow heat-conducting properties, is incalculable.

England still consumes a full two-thirds of the output of her mills, and America is so sensible of her personal comfort that while she hampers Yorkshire worsted cloths in every possible way with her tariffs, she is only too pleased to make special terms in the case of English flannels and blankets. "Our Lady of the Snows," too, may resent the name when applied to her in her character of universal wheat provider, but she knows the value of good English-manufactured wool, nevertheless, and spends more money on the commodity every year than all the other parts of the Empire put together.

There is a division of opinion among experts as to what wool really is, one contending that it is a modified form of hair, and another that wool

and hair have no affinity whatever. The former opinion is held by Professor Barker, the well-known Yorkshire authority, and it must be said that he makes out a very strong case for his contention. There is no doubt that the covering of many animals of the family to which the sheep belongs is hair, and the wilder the animal the coarser and rougher the hair. When wild sheep are brought into captivity, the hair on their bodies diminishes in quantity and the growth of wool increases; and when domesticated sheep are left to return to a wild state, they display a decided tendency to the formation of hair among the wool. Just at what point an animal fibre ceases to be hair and becomes wool it is impossible to determine. Professor Barker, who wrote the excellent article on the subject which appears in the "Encyclopædia Britannica," states that one gradually merges into the other, until a continuous chain can be formed from the finest and softest merino wool to the rigid bristles of the wild boar. Thus, he says, the fine soft wool of the Australian merino merges into the cross-bred of New Zealand; the cross-bred of New Zealand merges into the long English and lustre wool; which in turn merges into alpaca and mohair—materials with clearly marked but undeveloped scale structure. Again, such animals as the camel and the Cashmere

goat yield fibres which it would be difficult to class rigidly as either wool or hair.

The writer on the subject in "Chambers's Encyclopædia" differs on this point. Wool, he says, is frequently defined as a species of hair, but it differs from this filament in possessing a more fully developed serrated circumference, and an increased degree of flexibility, waviness and elasticity. Youatt, an older but very influential authority, thus describes the differences: "The fibre of wool is crisped or curled, the curls increasing with the fineness and felting property of the wool, and in addition to this its surface is decidedly serrated. On the contrary, hair, though sometimes curled, has its surface only scaly or rugose, and never truly serrated; and hence it is that hair, though it will entangle and harle, will not felt into a compact mass. As respects chemical composition, hair and wool are alike."

Mr. Walter S. B. McLaren, M.P., who speaks with full practical knowledge, thus amplified Youatt's description of hair and wool: "A hair has a smooth surface, comparatively free from jagged edges or serratures of any size, and lies straight; while the fibre of wool is more or less waved, and is covered with serratures. A fibre of wool may, in fact, be likened to a serpent's skin or to a fir cone covered with scales. The serra-

tures, or saw-like teeth, representing these scales, overlap each other and present innumerable little points, which act as hooks. They are extremely small, and in the fibre they are said to run from 1,200 to 3,000 per inch. When wool is spun these serratures to some extent fit into or catch each other, and help to bind the fibre together; consequently, other things—such as length, quality, &c.—being equal, wool which has many serratures will spin better than wool which has few."

Under the microscope it can be seen that in the fibre of the fine merino there are about 2,400 serrations in the space of an inch, while in the finest quality of all—the wool from Saxony—no fewer than 2,720 serrations to the inch have been counted. Wools of coarser quality have fewer serrations and lower felting properties; that is to say, they are smoother and do not so easily cling together.

On examining the wool fibre more minutely, says one authority, it is found to consist of three principal parts—(1) the outer scales; (2) the inner bark or cortical substance; and (3) the medullary or central portion. The external scales may be defined as flattened horny cells. They form the sheath or bark of the fibre. Their dimensions, uniformity, soundness, and compactness determine the lustre, firmness, and strength of the

wool. The felting or fulling power is also primarily due to their presence in the fibre, being high or low in proportion to their multiplicity and strength. These marginal scales are the most numerous in fine wools, and, as indicated in relation to wool, mohair and cashmere, differ so largely in formation and arrangement in different kinds of wool as to make it feasible in some instances to distinguish the variety of fibre examined by its serrated surface. The interior of the filament is composed of spindle-shaped cells. Upon the density of these cells—which form the largest proportion of the fibre—the elasticity and trueness of the wool depend. Moreover, this part of the fibre is said to possess greater affinity for colouring agents than the external scales. The third or medullary part of the wool filament consists of several layers of oval cells which form the pith or core of the fibre. Occasionally these run the entire length of the hair, but they may only occur at intervals. Their functions in the structure of the fibre have not been fully determined.

There are not only very great differences between one breed of sheep and another with respect to the quality of wool they yield, but there are also great differences in the quality of wool obtained from any individual sheep, and the buyer

of wool for the manufacturer, therefore, must of necessity be a man of great experience and keen observation. He has to examine it not only for length of "staple"—which is the technical name for a lock or strand of fibres—but for fineness, for strength, for its lustrousness, its felting properties, and for many other special and peculiar qualities.

Appearances to any but an expert might be very deceptive. Take, for instance, the strengths of the best-known long and short wools. Lincoln wool, in point of strength, is far superior to the wool of the Australian merino sheep, its breaking strain, according to Bowman, being 502 grains, while the Australian is 50 grains; but for all that, it is said to be possible to obtain from the short merino wool a cloth capable of sustaining greater strain and friction than can be produced from Lincoln. The reason given is two-fold. In the first place, the merino is ranker in growth and the staple more compact; and, secondly, it has superior felting power to the English wool, a quality which gives greatly increased wearing strength to woollen fabrics.

Burnley, the well-known author of "Wool and Wool-Combing," minutely classifies the various grades of wool to be found on the fleece of each sheep. The best part of the fleece of course—that is to say, the closest, longest, softest, and most

even—grows on the shoulders and sides of the animal; the yield of the neck is a trifle inferior, and on the loin and back there is a perceptible falling off in fineness and length. On the upper part of the legs the staple begins to hang considerably, and the wool of the upper part of the neck is of worse quality and is inclined to be faulty. At the root of the tail the fibre is coarser and more glossy; and at the lower part of the leg the grease in the wool imparts a darker shade, and the staple shows a disposition to twist. On the throat the fineness, softness, and curliness reach the vanishing point, and patches of false hair occur; the wool on the head is short, coarse, harsh, and extremely glossy; that on the lower part of the throat and chest is of the same quality as that on the throat itself, though shorter through the friction against bars and fences, while the portion of fleece growing on the shin is short, glossy, coarse, and dirty.

Broadly speaking, wool is used for the production of two grades of articles—"woollens," which comprise flannels, blankets, tweeds and various heavy milled cloths, and "worsteds," the lighter, finer "stuffs," and the fancy cloths and serges used by the dressmaker and the tailor. The first-named are produced in all parts of the British Isles, but chiefly in the Dewsbury and Batley district of Yorkshire, in that district of Lancashire

which has Rochdale for its centre, in Hawick, Galashiels, and other towns beyond the Scottish border, and in the West of England; while worsteds are made almost entirely to the east of the Pennines in Yorkshire, the principal district outside Yorkshire being that of Hawick, in Scotland.

As regards the relative importance of the two sections, it may be stated that out of some 260,000 persons employed in these industries in the United Kingdom in normal times about 190,000 are engaged in the worsted trade of Yorkshire. Bradford is the centre of this great worsted industry, and four-fifths of all the wool imported into England as well as a huge proportion of the home supply, goes to that city to be combed into "tops" and spun into yarn. The quoted figures respecting the number of workpeople engaged in the woollen and worsted trades do not, of course, include the many thousands employed in the hosiery trades of the Midlands, where vast quantities of woollen yarn are consumed.

The main differences between woollen and worsted are to be found in the processes of manufacture, the one being "carded," and made chiefly from the merino and shorter-stapled colonial wools, and the other "combed" from the longer Lincoln, Leicester, and other British wools. At least, this was formerly the broad distinction,

but, as Burnley says, the mechanical contrivances of modern days have greatly extended the scope both of the woollen and the worsted manufacturer, giving the former command of wools that in times past would have been too long for his use, and extending to the latter an equal power over shorter wools which under the old system could not have been handled in the worsted processes. Perhaps it would be better to say, therefore, that the buyer nowadays is swayed more by the question as to whether wools have the felting or non-felting qualities, for in woollens, felting, or matting together the fibres of wool into a compact substance by means of rolling, beating or pressing, is an important part of manufacture; whereas worsteds are not matted at all in most cases, but spun, woven, and finished in such a way as to keep the threads parallel and the texture clearly outlined. The short and curly wools are in consequence more adapted to the felting process such as is brought into operation after weaving flannels, blankets, and the fabrics which are intended to produce the more densely-milled cloths, while the longer wools are more fitted for the worsted manufacturer.

The manufacturer of woollens has an advantage in that he can at the present day employ almost all kinds of woolly fibres—short or long, thick or thin,

curly or straight; while in worsted the short and refractory fibres have to be eliminated, and the curly threads straightened and smoothed out as much as possible. For woollens, which are many times heavier and bulkier than worsteds, the fibres are placed in all directions, overlapping and crossing each other in every conceivable fashion; while for worsteds they are kept straight and parallel. As regards the results from the different processes of manufacture, the average woollens, after being beaten and shrunk, will be four times heavier than worsteds, although worsteds, made from more tightly twisted yarns, may actually be the stronger in the piece.

CHAPTER V

THE WORLD'S WOOL SUPPLY

When an estimate has to be made of the sheep upon a thousand hills, and those hills in far and remote corners of the world, it will be seen that the task is no easy one, and the difficulty is not decreased when one attempts to form an idea of the world's wool supply. The statistics relating to wool are notoriously at variance. One difficulty lies in obtaining definite figures relating to "scoured" and "greasy" wool, and the yield of the clips must of necessity greatly vary from year to year in every country. The estimates of such high authorities as "Dalgety's Annual" and the Association of Wool Manufacturers are often a long way out; indeed, there is many a time a discrepancy between the big wool experts of many millions both in the number of sheep and the number of pounds of wool the sheep yield.

Calculations, again, have recently been altogether upset by the great European War, with its abnormal demands for military purposes, and the upheaval it has caused in the markets of the

world. The British manufacturers of wool have known no such activity since the Franco-German War, and, when war broke out all kinds of difficulties arose owing to the unprecedented demand for raw material. Not only was there a call for every available pound of wool sheared since the war began, but old stocks were drawn upon to their utmost limit. Transport difficulties, too, added burdens previously unknown. Owing to the heavy demands upon shipping by the military authorities, the number of vessels available for carrying wool from Australia and South America proved totally inadequate. Matters were not improved during the time German warships were at large in the Pacific and the Atlantic, and private buying of tens of thousands of bales of wool in London just before the outbreak of war, presumably for shipment to Germany, complicated things still further.

Those trades which were concerned with the supply of munitions of war and with the victualling and equipment of the fighting forces were thrown into a state of tremendous activity. To clothe in a few months an army of two or three million men was a big enough task in itself, but on the top of that the wool industry of England was called upon to provide a large part of the clothing needed by the armies of the Allies. Hence

a rise in the price of wool altogether unparalleled, and hence an embargo on exports, "reviving a restriction which was thought to have been swept away for ever with the repeal, a century ago, of the then already long obsolete statute of Charles II.—the same statute that required every Englishman to be buried in a woollen shroud."

The war, indeed, brought about a curious state of things, for while a languishing trade in the woollen districts was suddenly revived and swollen to an extent which put an almost unbearable strain upon both workers and machinery, the worsted section was for a time brought almost face to face with utter ruin. This was due to the disorganisation of the whole export trade. More than half the trade of Bradford, the great centre of the worsted trade, is with Germany and Austria, and what little trade might have been maintained with allied and neutral countries was cut off by the embargo. Consequently, the financial position, in Bradford especially, at once became most acute. It was estimated there were due to that city from Germany and Austria accounts amounting to £1,750,000, the liquidation of which was impossible while the war lasted; whilst the total indebtedness to Bradford merchants from all countries when the war broke out was put at about £7,000,000. Some relief was eventually

given to the financial situation by the Government arranging for banks to advance 50 per cent. of approved foreign debts, but though this improved the relations between merchants and spinners, the former, in face of the prohibition of certain classes of exports, were for the most part left in a very awkward situation.

It will thus be seen that not only is there the initial difficulty of estimating the world's stocks of both sheep and wool, but that the most recent export and other figures would be totally misleading as a guide to what obtains in ordinary peace times. For our purposes it would perhaps be well to take the year 1913 as the period for computation and comparison. Going back, therefore, to the state of things which existed before the war, we find that the number of sheep in the world at the close of 1913, as estimated by the National Association of Wool Manufacturers and set forth in that excellent publication, the "Wool Year Book," was:—

United Kingdom . . .	31,082,461
Other European countries .	148,433,976
Total (Europe) . .	179,516,437
Australia and New Zealand. .	117,011,654
Asia	110,058,874
Africa	51,429,279
North America . . .	59,047,680
South America . . .	109,693,142
Total (world) .	626,757,066

There is a concurrence of English, American, French, and Australian estimates giving a total of 3,000,000,000 lbs., or thereabouts, as the probable weight of the supply of wool in the raw state. After washing, however, it would not weigh more than half this figure.

Captain C. E. W. Bean, the well-known Australian writer, presented an interesting analysis of the world's wool figures in a paper read before the Colonial Section of the Royal Society of Arts some time ago. Taking Dalgety's figures as his basis, he pointed out that of the 615,000,000 sheep of all classes, which that authority gives as the world's estimate, nearly 93,000,000 were in Australia, 24,000,000 in New Zealand, and 22,000,000 woolled sheep were in South Africa. That is to say, that in these three British States in the

Southern Ocean, which possessed scarcely any flocks at all a hundred years ago, there have grown up flocks of sheep which in the aggregate amount to nearly 139,000,000 head—by far the most important section of the world's sheep population at the present time. If to these are added the 4,000,000 valuable angoras of the Cape, the flocks of Canada and the Falkland Islands, and the 30,000,000 sheep of the British Isles—still among the most important sheep-producing countries in the world—the total for the countries within the British Empire amount to nearly 180,000,000. Although this excludes the sheep of British India (some of which are woolled sheep of considerable value) and the unwoolled sheep of Africa, yet it amounts to nearly a third of the world's sheep in numbers, and very much more than that in value. When it is remembered, said Captain Bean, that the only land amongst all these which was of any importance a hundred years ago was Great Britain herself, the great change which has taken place during the last century may to some extent be realised.

Nearly every country in Europe produces wool in greater or less amount—not omitting the coarser varieties grown in Iceland and the Faroe Islands. Russia, with its vast area of pasture country, takes first place in number of sheep, but

the quality is greatly varied. A fair amount of merino wool is grown in the Don district, but, speaking generally, the sheep, like the majority of those which form the Asiatic flocks, are best suited to provide wools for carpet-making. Asiatic Turkey exports some good carpet wools, as do China, India, and neighbouring countries. Recently India has made an effort to improve the native breed by importing merino rams, and the reports so far are most satisfactory.

The "Silesian merino," produced in Germany, is regarded as the finest wool in the world, but it is a fast-vanishing quantity. During the last quarter of a century the stock has fallen from about thirty millions to seven millions, and, although within recent years an effort has been made to revive the industry, it is generally found that it is cheaper to import the wool from Australia and other places than to grow it. The Silesian sheep are descendants of a flock presented by Spain to the Elector of Saxony in 1765, and were for a long time assiduously cultivated. At one time, for instance, the universities were charged with the work of improving the breed, and a professorship was established intimately to study the question.

Saxony, where the merinos were first introduced from Spain, was, by the way, one of the chief

sources of the British supply until the rise of Australia to the position of a great wool-growing country. Up to the middle of the nineteenth century the home growth of wool for manufacturing purposes was chiefly supplemented by imports from Spain and Germany, but since that time Australia has come rapidly to the front, with the result that even Germany herself finds it more advantageous to deal with the Antipodes. Saxony and Silesian wools, it is true, are still used in England, but only in small quantities, and chiefly for the making of the finer doeskins and kerseymeres in the West of England.

In a similar way, the merino sheep were introduced into France from Spain, and the French Government quickly took advantage of the opportunity to found the famous breed of Rambouillet, which is to-day known and valued all over the world. Austria also produces a good merino wool, but Spain itself, which formerly had a treasured monopoly of the merino, now produces a very inferior quality, which is not much better than rough carpet wool. Much of the wool of the sheep-growing countries in the Balkans and Near East is not of the best quality owing to the strong hairs to be found in it, but it is quite suitable for the production of the carpets for which that part of the world is famous.

Sheep are to be found in many districts on the African continent, but it is in Cape Colony, the Orange Free State, the Transvaal, and Natal that the most ambitious attempts at wool-growing are to be found. There are now over 30,000,000 sheep and 12,000,000 goats in the South African Union, but half the sheep are of a "bastard" sort, and almost woolless. The merino is the breed which does best on the coarse vegetation of the veldt, and in the Transvaal, particularly, much money has been spent during the last few years with the object of improving that breed. All experts agree that there is a great future for sheep in South Africa, both from the point of view of mutton and wool.

America, North and South, now produces a vast quantity of wool of good quality. Canada has not hitherto gone in extensively for sheep farming—there are not 3,000,000 sheep in the whole Dominion although there are projects afoot for encouraging their settlement on the great prairie lands in the West—but in the United States there are over 50,000,000 sheep and lambs, more than half of which are of pure or high-class merino breeds. South America has proved particularly suitable for sheep-raising, and buyers in England are enthusiastic as to the present production and future possibilities of the more southerly parts of the

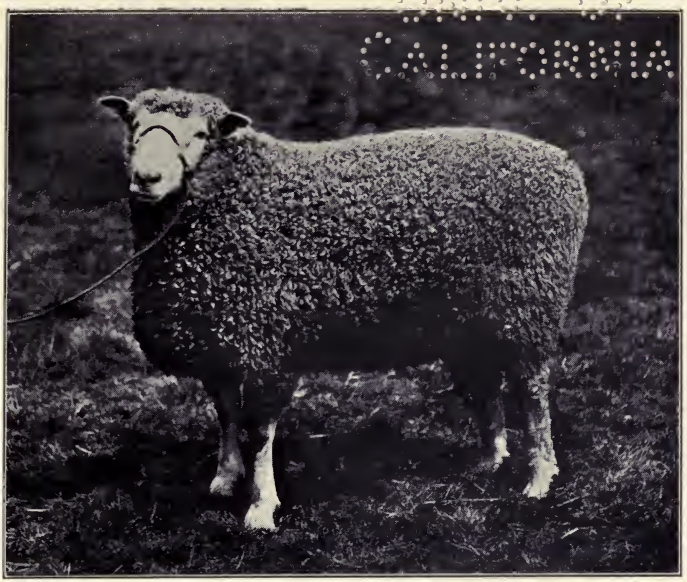
American continent. The Argentine Republic alone has nearly 70,000,000 sheep, but in the near future it is more than likely that the numbers will decrease, owing to it having proved more profitable for the country to grow wheat and breed cattle for the already enormous meat trade. The country, however, is well adapted to sheep, and the soil, which is very rich, is better suited for mutton purposes than for wool. It is a curious fact in connection with sheep-raising that within certain limits the poorest land can be relied upon to produce the finest quality of wool.

In the Argentine about three-quarters of the stock are strong cross and mutton breeds, the remainder being merinos and kindred fine-woolled sheep. Uruguay, on the contrary, is warmer and less suited to agriculture, with the result that fully 80 per cent. of the 26,000,000 sheep to be found there are of the fine merino breed. They are principally the French Rambouillets, and the remainder are good cross-breds produced from merino ewes and Lincoln or Romney Marsh rams. Another South American wool which is very popular with English manufacturers is grown on the island of Tierra del Fuego, which is regarded as one of the best sheep countries in the world. The wool, mostly cross-bred but of a good, strong quality, is known to the trade as "Puntas Arenas,"

the name of the port from which it is shipped, and it is in great favour in the hosiery and other trades where a full, bulky wool is an advantage. Some of the best Cheviot wools come from the Falkland Islands, where Cheviot sheep were originally introduced by the early Scottish settlers.

The British wools are too various to set out in detail here. Cross-breeding has given nearly every part of the country a class of its own, so that it is possible to find in Great Britain almost every length and quality of staple from the Lincoln to the Southdown. The last-named is the shortest and finest of the native wools, and is eminently suited for flannels and other woollen goods, while the Lincoln and Leicester wools (the latter regarded as the choicest long wool in England) are, on account of their lustrous qualities, greatly esteemed in the worsted trade for their suitability for making up into the finest dress cloths. Between the wools named come a number of "demi-lustre" wools, such as the Romney Marsh, Cotswold, Wensleydale, Devon, and others, while the list of Down wools include Shropshire, Oxford, Suffolk, and many of the South of England wools.

There are also a number of special wools, the best known among them being the Shetland and Cheviot. Shetland wool, as is generally known, is used for hosiery and knitted goods, while the



A NOTED PRIZE-WINNING LEICESTER RAM—AN EXCELLENT LONG-WOOLLED BREED

(By Permission of the Well-Known Breeder, Mr. E. F. Jordan, Driffield, East Yorks)

A GOOD SPECIMEN OF THE ROMNEY MARSH SHEEP

(By Courtesy of Mr. J. Egerton Quested, Cheriton, Folkestone)

Cheviot wool is retained in Scotland for the making of tweeds. So eager are the manufacturers of Scotch tweeds to secure the wool of the Cheviot sheep that they arrange with the local farmers beforehand to take all their wool, and as a special inducement often agree to pay a penny a pound above the market price. The result is that sheep raising is especially encouraged in the Lowlands of Scotland, and over a million, chiefly Cheviots, are to be found in the border counties alone. There are, indeed, said to be more sheep per acre in the counties of Roxburgh and Selkirk than anywhere else in the world.

It will be interesting to watch the future developments of wool-growing. Already the air is full of great potentialities—changes which may in the next decade have a profound effect upon the sources and quality of our supplies. Less of the finest quality merino wool is being produced in Australia, and the quantity is likely still further to decrease in future. The reason is two-fold. The growing demand for frozen mutton is encouraging the squatter and farmer to cross their small fine-fleeced merinos with the bigger, long-woolled English breeds, and the result is a cross-bred wool eminently useful, but not nearly so fine and soft as that from the pure merino. It is, of course, a matter of pounds, shillings, and pence

with the farmer, and the growing popularity of cross-breeding seems to indicate that the heavier carcase and the slightly inferior fleece are likely to pay better than the higher-priced first-quality fleece *minus* the carcase.

At present New Zealand is the country doing most in the way of cross-breeding, and, according to the experience of the farmers there, the most popular ram to cross with the merino is the Romney Marsh. By this means the dominion is getting a big-bodied sheep and a quick-maturing lamb—an animal, of course, far superior to the merino for the special purposes for which it is required. Australia is crossing with the Leicester, Romney Marsh, and others, the result being that already more than a quarter of the wool from Australasia is cross-bred, and the proportion is always increasing. New Zealand, indeed, will shortly cease to be a merino-producing country if her present rate of conversion is maintained. Exactly the same process is going on in the Argentine, where three-quarters of the flocks are now cross-bred.

South Africa has not yet done much in the frozen-mutton trade, and consequently she still retains her flocks of fine-woolled sheep; but as she is much nearer the English markets than Australia, even she may be tempted to change

the breed and the size of her sheep before long. In Australia, says Captain Bean, the flocks on the coast are rapidly changing to cross-bred, and not only farmers, but hundreds of the big squatters in accessible districts have broken away from their old policy of breeding merinos purely for the excellence of their wool. This they are not doing without weighty protests being made, notable authorities like *Dalgety's Review* being by no means sure that in the long run the policy will prove the most beneficial. It is pointed out that while it takes only twelve months to produce a cross-bred flock out of the pure merinos, it will perhaps take twenty years to breed the wool fine again, and therefore it is highly important that some, at least, of the famous old merino flocks should be kept intact.

Another thing which is said to be working detrimentally to the interests of fine wool is the decision of the Federal and State Governments in Australia to break up the big ranches into small farms for growing wheat and other cereals. Young countries, it is contended, are obliged to open up lands where perhaps there are now kept only one or two sheep to the acre, but in breaking up these great runs the wool produced is hardly likely to be so uniformly good. It is argued that breeding can never be so even in small flocks as in large

ones; that the farmer's few bales cannot be so rigidly classed as the big clips of the squatter, and that the farmer cannot possibly pay the money for rams to improve his flock that the bigger men can. On more than one occasion as much as £1,500 has been paid for a prize ram, and obviously such prices as these are out of the reach of the small farmer.

Still, although the day is going when one man can control 60,000 square miles of country and turn out his sheep and cattle upon a holding amounting to 40,000,000 acres, there will be for a long time to come plenty of elbow-room in the interior of Australia, South Africa, and other young countries, especially as irrigation has now made possible lands which formerly were regarded as hopeless for live stock of any kind.

Sheep, it may be remarked incidentally, are excellent pioneers in virgin or only partly-settled countries. They always improve the land on which they graze. What was a barren waste with only a tuft of grass here and there, will soon become fit for cattle and mixed farming if sheep are turned upon it, and, this being the case, it is clear why the holdings of the squatters in Australia are coming into favour as places upon which to settle the small emigrant farmer.

In a chapter in which an attempt is made to put

before the reader the enormous dimensions to which the industry of sheep-raising has grown throughout the world a few figures respecting the wool trade generally will no doubt be found of interest. The report of the first census of production of the United Kingdom in 1907 scarcely covered the ground, but at least it gave some idea of the magnitude of the industries with which it was concerned. It showed, for instance, that of the 7,000,000 workers returned as employed in all the groups of industries covered by the census, no fewer than 1,250,000 were employed in the textile group, and nearly 2,000,000 of those engaged in making textile machinery and apparel were included. Nearly one-half of the textile workers are occupied in the cotton trade. Next in importance comes the woollen group of trades, giving employment to more than 20 per cent. of the total. The persons employed in the manufacture of wool, worsted, and shoddy in the United Kingdom are stated in the Factory Returns to number 261,192, and the gross output or selling value of the products of the woollen and worsted industries is returned at £70,331,000. Of this sum England and Wales are responsible for £63,652,000, Scotland £6,072,000, and Ireland £607,000. The Board of Trade estimates that there is probably over £10,000,000 paid in wages

in the British woollen, worsted, carpet, flock, and shoddy industries.

It is well to remember also that the figures given above do not include the hosiery industry, which is largely concerned with wool, and has a gross output of £8,689,000. The flock and rag factories, which have an output of £852,200, are also not included in the estimate, and, again, no account is taken of the dyeing and finishing industries, which on the wool side represent in value over £2,500,000 and employ over 100,000 people.

Of the 261,192 persons given as employed in the wool trades, 102,030 are engaged in spinning and weaving woollen and 116,534 in spinning and weaving worsted, although there are actually more woollen than worsted factories and the spindles and looms show very little variation in number. In the worsted branch, it is worthy of note, there has been an enormous increase in spinning and doubling machinery, accompanied by a substantial decline in the number of power-looms. The speeding-up of looms may have done something towards swallowing up the increased output of the spindles, but the real explanation is no doubt to be found in the fact that, whereas formerly most of the yarn produced was woven into cloth in British factories, a large part of it has

in recent years been exported to Germany and other Continental countries.

America is increasing its demands year by year, and there have actually been years when the consumption of wool in the United States was higher than that of any other country. This was the case in the year 1909–10, there being retained for consumption 587,983,508 lbs. of wool, of which 263,928,000 lbs. were imported, the balance being provided by an extraordinary home production. There was a marked falling off from this total in the following year, the quantity retained then being 450,804,692 lbs. Against these figures the quantity used for manufacturing purposes in the United Kingdom was about 490,000,000 lbs., in France 460,000,000 lbs., and in Germany 380,000,000 lbs.

The following table gives a fairly accurate idea of the average quantity of wool used annually for manufacturing purposes in certain principal countries:—

	Lbs.
United Kingdom	515,000,000
United States	505,000,000
France	480,000,000
Germany	400,000,000
Austria-Hungary	140,000,000
Italy	60,000,000

It is believed, however, that the United States is not nearly at the full extent of her production, for in addition to her own manufactures she is a very large importer of woollen fabrics.

So far as Great Britain is concerned, we find that no less than 872,000,000 lbs. of wool, mohair, shoddy, &c., were consumed in 1913, while the consumption of raw sheep's and lambs' wool alone was 590,000,000 lbs. These figures have shown great expansion during the past twenty years, the increase in the sheep's and lambs' wool consumed being over 30 per cent., and that in the total of all wool, mohair, shoddy, &c., over 40 per cent. The proportions of home and imported supplies of raw sheep's and lambs' wool will be seen from the following analysis of the figures for 1913:—

	Lbs.
Net imports into the United Kingdom	494,000,000
Estimated domestic clip, less exports of British produce .	96,000,000
Total consumption .	590,000,000

The chief sources of the supply of imported sheep's and lambs' wool are British, the Empire containing about a third of the world's sheep, and these of the very highest value.

The exports of the woollen trade are analysed

under three headings—the exports of tops, the exports of yarns, and the exports of manufactures. The exports of tops amounted in 1912 to £3,500,000, of which over £1,000,000 went to Germany. The total exports of yarns amounted to £8,200,000 in 1912, and of manufactures to £26,100,000.

CHAPTER VI

AUSTRALIA'S PASTORAL ROMANCE

MARK TWAIN, in one of his travel books, tells a story purporting to show how Cecil Rhodes made his first hit in life. The future South African magnate, wandering aimlessly along the quayside at Sydney, New South Wales, was accosted by a fisherman, who wanted assistance in landing and dressing a shark. Young Rhodes was promised half of what was found inside the shark, but contented himself with a scrap of paper he discovered there. On the paper was the announcement of the outbreak of the Franco-German War, and the effect it was likely to have on various trades, and notably the woollen. The shark, it was surmised, had picked up the paper at the mouth of the Thames just as it was starting for southern seas, and had beaten by days the ordinary steamship service to Australia—a circumstance which enabled Cecil Rhodes to raise enough money to "corner" the whole of that season's clip of the Colony's wool.

The story was told to illustrate the shark's

natatory powers, but it might very well have stood to show how great were the difficulties under which the early industry of wool laboured at the Antipodes fifty or sixty years ago. Then the sheep farmer was hardly a being to be envied, for not only had he to contend, alone and unequipped, with drought and famine and pestilence, but being without cable, and dependent upon slow-going "ocean tramps" for the transport of his wool, he was at all times the sport of circumstances unknown to him, and at the mercy of every whim of the home dealer. Now he is able to look with more complacency upon the world, knowing that, so far as wool is concerned, he holds the key to the whole industrial situation.

What happened before the squatter became the chief factor in wool is set out in the earlier chapters of this volume, but, fascinating as the story is, it is not more so than the pastoral romance which is woven round the whole history of Australia's national and industrial life. The story is one of deep Imperial interest.

Sheep of one kind or another have, as we know, been bred in England for long centuries, but it is not much more than a hundred years ago that Great Britain came into possession of the particular strain which was eventually to make one of her dominions the greatest producer of wool in the

world. How it all happened is told in an old Australian journal—the *New South Wales Magazine*. Spain, it is interesting to remember, was the original home of the merino sheep—a hardy, frugal, white-woolled animal which could live on land where most sheep would starve, and which had been patiently developed from certain native sheep said to have been quite black. This merino breed, which produces the softest of all wool, and also the finest and whitest, seems to have been greatly coveted by the stockkeepers of every other country in the world, but for a long time the Spanish authorities closely protected their valuable asset, and would only consent to export the fleeces. How well they succeeded in maintaining their monopoly can be gathered from the fact that while they allowed none of these sheep to leave their shores, they were selling to England alone 6,000,000 lbs. of the 8,000,000 lbs. of wool this country imported from abroad in the opening years of the nineteenth century. Once or twice, as a rare concession, the rigid rule made by the Spanish was relaxed, and a foreign king or Government was presented with a flock of merinos in recognition of favours past or to come. In this way George III. came into possession of some of these sheep in 1787 and again in 1791, but otherwise a strict embargo was put upon their export,

and for a long time they were not allowed to fall into the hands of anyone who might possibly become a competitor.

It was, however, a woman's ingenuity and resource which finally overcame all difficulties, and broke down the protective wall which surrounded these precious wool-bearing animals. According to the story in the old magazine mentioned, the wife of a certain Spanish ambassador to the English Court was given a pair of much-admired creamy Hanoverian coach horses in order to put her under an obligation, and it was then suggested that some merino rams would be an acceptable present in return. The diplomacy having succeeded, the great lady cast about for some means of fulfilling her part of the bargain, knowing full well that it was little use approaching the Spanish Government on the subject. The easy manners of that day answered her purpose well. Smuggling was in its heyday, and to some of these "free trading" gentlemen of her own country she applied, with the intimation that she would like to have "selected" a few good rams from various well-known flocks. The "selection" was duly made, and the sheep were eventually brought to England.

Whether this is what really happened we do not know, but it has to be remembered that the

monopoly had to some extent been broken down previously through the medium of presents made by the Spanish Government itself between the years 1768 and 1809. The Saxons, Austrians, Dutch, English, and Americans all benefited in this way. The Saxon flock, it is stated, was established at Lohmen, and was gradually developed until the wool produced was the finest ever known. The Austrians placed theirs at Hostitz, the French at Rambouillet, the Americans at Vermont, the Dutch sent some of theirs to the Cape of Good Hope, and George III. kept his on his farm at Kew, and all developed the sheep in different ways. It was from the Dutch and English contingents, the least important flocks originally, that Australia got the sheep from which she built up the greatest and most famous flocks in the world.

It was a young officer—Captain John Macarthur, of the 102nd Regiment, stationed at Sydney—who had the credit of founding the Australasian flocks; but the Commonwealth, especially, is indebted to Macarthur for his great foresight and enterprise. What the introduction of sheep has meant to the great lands "down under" can readily be gathered from the fact that Australia now sends to England alone anywhere up to 320,000,000 lbs. of wool each year,

and the big islands lying 1,200 miles from Australia, which are now the Dominion of New Zealand, but which a little over a hundred years ago had not a white man nor a sheep upon them, sends an additional cargo of between 180,000,000 and 190,000,000 lbs., valued at something over £8,000,000. Spain, where the merino came from, has long since ceased to send any at all. The Peninsular War started the downfall of the old Spanish trade, and a preferential tariff put on by England in favour of her own colonies finished it.

Captain Macarthur went to Sydney two years after the Colony was founded, and seems to have been convinced from the start that the country offered great possibilities for sheep-raising. He started modestly enough. Despite the great difficulties of that day in obtaining transport, he managed to get shipped to him thirty Bengal sheep from Calcutta, but the undertaking took him a matter of three years. And when the animals arrived they could not be considered as very great prizes. They have been described as "skinny, long-legged, razor-backed animals, with not an ounce of anything approaching wool upon them," but the Captain found that when he crossed them with one or two Irish sheep he obtained, the progeny were covered with a fleece

which was "distinctly less like hair and increasingly like wool."

This gave him the idea that if he could only obtain some good Spanish sheep he might eventually cover his flock with a fleece of some value. By a lucky chance he heard that the widow of a certain Colonel Gordon, of the Dutch East India Company, had decided to sell a flock of Spanish merinos which had formerly been sent to the Cape by the Dutch Government, and he at once commissioned the captains of two vessels, sailing from Sydney to the Cape for stores, to buy all the fine-woolled sheep they could get in South Africa. The two captains are said to have bought twenty-six sheep at £4 each, and when they arrived back in Sydney, Macarthur endeavoured to buy them all, offering as much as £15 each. He is said, however, to have managed to buy only eight—three rams and five ewes—but with these and his razor-backed Bengals he laid the foundation of the whole of Australia's vast flocks.

To-day the great source of Australia's wealth is her pastoral industry. The fine wool from her merino sheep fetches the highest prices in the world's markets, and goes away by millions of bales a year. Following the example of the founder, the Australian pastoralist of to-day is a scientific stock-breeder, and his accomplishments in raising

STUD MERINO RAMS ON A NEW SOUTH WALES FARM
(*Australian Government Photo*)

"TO SEE THE MERINO IS TO BE CONVINCED OF ITS MARVELOUS WOOL-PRODUCING QUALITIES"
(*Australian Government Photo*)

the standard of merino wool have astounded the world. The average fleece at the time Macarthur introduced the merinos weighed 3½ lbs. To-day the wool, hardly to be rivalled for its quality, shows an average yield from each sheep of over 8½ lbs.

The merino as it appears to-day presents a remarkable picture. "Feathered to the foot," its body covered with folds and wrinkles of wool, and its head almost hidden in the depths of encircling fleece, the animal developed from the old Spanish breed may not be so attractive to look upon as a Leicester or a Suffolk, but to see it is to be convinced of its marvellous wool-producing qualities.

The great proportion of Australian sheep—probably 85 per cent.—are of various types of the merino. These types range from the comparatively small-framed, dense-woolled, fine quality sheep for which Tasmania is so famous to the big-framed, stronger-woolled merinos for which South Australia is equally well known. In each State, and in almost every important sheep-breeding section of each State, there are flocks noted for the production of some specially valuable class of wool which local conditions and skilful breeding have evolved. The remaining 15 per cent. of Australian sheep are cross-breeds. With the devel-

opment of the export trade in lamb and mutton more attention has been paid to sheep of all the British breeds.

Probably the Lincoln sheep are the most numerous of those introduced for crossing, followed in numerical order by the Leicester, Shropshire, Southdown, Border Leicester, and Romney Marsh. In the majority of cases the long-woolled sheep are crossed with merinos, as it is found by such means that not only can a useful carcase for export be obtained, but also a class of wool which commands ready sale at remunerative prices. The Australian climate has, in some respects, changed the character of the Spanish fleece. The wool has become softer and more elastic, and while it has diminished in density it has increased in length, and the weight of the fleece has grown considerably. The quality of the wool may be said to have improved, on the whole, under the beneficial influence of the climate.

The extent of Australian territory naturally adapted to the production of merino wool may be said to comprise nearly the whole of Queensland and New South Wales west of the great Dividing Range, with the exception of the country bordering the Gulf of Carpentaria; practically the whole of Victoria, with the exception of the heavily-timbered tracts of the south-eastern division, and

the rich volcanic soils of the south-western division; nearly two-thirds of South Australia; and probably the greater part of Western Australia, with the exception of the sub-tropical fringe of the north and north-west coast, and some of the country of the eastern section of the State. In the Northern Territory there are also extensive tracts of sheep country. From this vast expanse it is necessary to deduct in each State fairly extensive areas which at present are impracticable for sheep for various reasons, but it is probably quite correct to state that there are about two millions of square miles of land in Australia capable of carrying sheep on natural pasturage in normal seasons.

Some portions of the country are, of course, capable of carrying more sheep than others, and in many parts of it sheep-rearing is likely to remain a precarious undertaking until large sums have been expended on improvements and water conservation. In many districts where, prior to the discovery of the existence of artesian water, millions of sheep perished in the midst of abundance of food, there are now, however, ample supplies of water flowing from artesian bores. The discovery of artesian water has, in fact, completely changed the outlook over thousands of square miles of country where surface water

was the only want, and has opened the way for the pastoral occupation of areas as yet barely touched. It has also enabled sheep to be travelled where formerly such a thing was difficult or impossible.

As far back as 1860 Australia had already won a recognised place among the world's great wool producers. Since then, with great strides, she has made her way to the very front, and remains there, despite the vicissitudes to which an industry of such enormous scope is naturally liable. In 1860 the sheep on Australian pastures totalled 20,135,286; in 1870, 41,593,612; in 1880, 62,186,702; in 1890, 97,881,221. In 1902, the year of the great dry spell, the colossal total was reduced by nearly one-half, namely, to 53,668,347. Since then a great and practically continuous recovery has taken place, until, at the end of 1913, the number of sheep in the Commonwealth had again climbed up to 85,049,697. New South Wales remains the leading wool-growing State, not only of the Commonwealth, but of the world, with something like 40,000,000 sheep. Queensland comes next, though at a long interval, with nearly 22,000,000.

Put shortly, in one hundred and twenty-five years the flocks of Australia have grown from a few head to over 85,000,000, by far the greatest num-

ber of sheep in any country; the weight of the fleece has been more than doubled, and the quality has been brought to such a pitch that it is difficult to say whether further improvement is possible.

The annual value of Australian wool exported is now about £31,000,000. Formerly the bulk of the output was shipped to Great Britain for disposal, but now buyers from various countries visit Australia to purchase their supplies at the sales held locally. Still, the quantity of Australian wool, for all that, sent direct to British ports constitutes nearly 45 per cent. of the total importations of wool to Great Britain. France comes next as the most important purchaser of Australian wools, the amount exported from the Commonwealth to French ports reaching nearly £6,000,000 worth of scoured and greasy wool per annum, with very large quantities of sheepskins. Germany ranks third in the scale of purchasers, with an annual importation of Australian wool of the value of over £5,000,000, while the value of the wool exported from Australia to Belgium exceeds two and a quarter millions sterling.

New Zealand, which has grown up alongside Australia as a great sheep-producing country, has also a wonderful record of progress. The country is eminently suited for sheep-breeding, practically

every description of sheep finding a favourable local habitat. In the hilly and down country of the South Island the merino has been bred for many years, and was the original sheep depastured. In fact, the merino ewe furnished the foundation of the cross-bred stock which has made Canterbury mutton famous on British meat markets. In the early days of the Canterbury meat trade the English Leicester of the original type was the favourite ram for cross-breeding with the merino ewe, but of later years the Lincoln has been largely employed for that purpose. In the North Island the Romney sheep, which suits the rather moist climate of this portion of the dominion, has become the most popular sheep, and it is also increasing in number in the South Island. The Lincoln and Border Leicester, however, are also greatly favoured in both islands, while the Southdown is displacing other breeds for fat-lamb production throughout the dominion. The Leicesters, mainly the English variety, are still the most popular British breed in the south.

The total of sheep in the dominion in 1913 was 24,191,810, which showed an increase of 5,237,257 between 1903 and 1913, representing a rate of increase of 27.63 per cent. in the ten years. Of the provincial districts, Wellington had most sheep in 1913, Otago came next, and Canterbury oc-

cupied third place. The average size of the flocks in 1913 was 1,124, which is very little different from the average twenty years ago.

Wool, although showing signs of decreasing quantity, is still the most important product of New Zealand. The annual value of the export is about a third of the value of the total exports of the dominion, the figures for 1913 being: Total exports of New Zealand produce, £22,577,890; wool, £8,057,620. The quantity of wool exported during the same year was 186,533,036 lbs., a decrease of 1,828,754 lbs. on the quantity exported in the previous year.

Thus, it will be seen that, while there is an increase in the number of sheep raised, there is actually a falling off in the amount of wool marketed, which is, of course, due to the circumstance that the dominion is now breeding for mutton in preference to wool. This is shown by the fact that cross-breds and other long wools now comprise 93 per cent. of the New Zealand flocks, the merino being less suited for freezing. During the year ended March 31st, 1914, 4,019,831 sheep and 4,338,180 lambs were slaughtered for food purposes, 2,557,639 carcases of sheep and 3,854,348 carcases of lamb being exported. In addition, it is estimated that 4,500,000 sheep, representing a weight of 270,000,000 lbs., and about 550,000

lambs, of a weight of 20,000,000 lbs., were killed by farmers for local consumption, the average annual consumption per head of population, including Maoris, being over 100 lbs. New Zealand supplies larger quantities of frozen mutton and lamb to the United Kingdom than do either Australia or South America.

The number of sheep in the several States of the Commonwealth of Australia and in New Zealand for the year 1913 was as follows: Queensland, 21,786,600; New South Wales, 39,842,518; Victoria, 12,113,682; South Australia, 5,140,166; Western Australia, 4,418,402; Tasmania, 1,745,356; New Zealand, 24,191,810; making a grand total for Australasia of 109,238,534.

CHAPTER VII

THE MARKETING OF WOOL

THERE is about wool something of romance in every stage through which it passes, and this obtains even in the usually prosaic business of buying and selling.

Perhaps in this instance it is the cosmopolitan character of the transaction which appeals to one, or it is the wonderful future of the great fleecy cargoes which are brought into the Thames from sub-equatorial lands that especially touches the imagination. It cannot fail, also, to be a matter of pride to the Englishman to reflect that for nearly a century buyers from all over the world have come to this country for their wool, and that the Metropolis has been the great clearing-house of the industry. Once it was Bruges that set the standard for the commodity of wool; later, York became the commercial centre for the woolstapler; but for the last three generations, at least, or ever since Australia began to be the great producer of wool, London has been the natural and accepted meeting-place for all who trafficked in the fibre.

From being quite small affairs held once in a way in a tradesman's shop, the London sales have become international in character, held regularly six times a year at the commodious Wool Exchange in Coleman Street. Here wool is sold from nearly all the most important wool-producing countries of the world. Wool is sent, for instance, from New South Wales, Tasmania, Queensland, Victoria, West and South Australia, and New Zealand, from the Cape of Good Hope, from the Falklands Islands, the Argentine, from Chili, and from far Peru. This wool is all packed and graded upon the same lines, and the largest buyers compete for its purchase, because on the London Wool Market they have the best opportunities of getting the kind of wool they want.

The first auction of wool from the colonies was held on August 17th, 1821, when 329 bales of wool from New South Wales, consigned by Captain Macarthur, the pioneer of Australian sheep-breeding, were offered at Garraway's Coffee House in Change Alley, Cornhill. One lot actually realised the extraordinary price of 10*s.* 4*d.* per lb., and was sold to a buyer named Hirst, of Leeds. With this wool was also sold wool which came from the Cape of Good Hope, from Spain, and from Italy. It is, therefore, nearly a century since the first ship, which had taken out its boat-

load of exiles to Australia, returned laden with a pioneer cargo of wool. Since then a whole race of sheep farmers and wool merchants have sprung up, who have transformed the conditions of industry by their determination and enterprise, creating a trade of world importance and world renown.

The London wool sales, which were first removed to Moorgate Street Buildings, and have for the last forty years been held at the present saleroom in Coleman Street, have now grown to such an extent that there are six series of sales throughout the year, each lasting about fifteen or sixteen days, and on the average 12,000 bales of wool are sold each day. The wool for sale in London arrives on consignment to various merchant houses, mortgage companies and banks, and is distributed among the firms of selling brokers for realisation on behalf of the consignors. The buyers view the wools at the docks and warehouses on the mornings of the sales, which take place at 4 o'clock every afternoon during the series, except Saturday, when the lots are put up for auction an hour earlier.

The way the London sales are conducted would surprise the uninitiated, who may, perhaps, only know the wool salesman as a mild-mannered family man. The eagerness to secure some of the "lots"

on the Exchange leads to remarkable scenes, and the abiding wonder is that the auctioneer is able to give any satisfaction whatever. When the bidding commences these otherwise staid gentlemen become as excited as schoolboys at a football match. No sooner has the lot been put up than a wild assault is made upon the eye and ear of the auctioneer, whose rostrum is situated at the foot of the tiers of seats occupied by the salesmen, and in full view of everyone present. The saleroom somewhat resembles the lecture theatre of a scholastic or medical institution in the arrangement of seats, being totally different from the cotton and other exchanges where dealers meet on the floor of the house and transact their business standing. Each wool salesman has his own particular seat, and members, to the number of several hundreds, sit round in crescent form with the auctioneer enthroned in the front centre.

Captain Bean gives an amusing sketch of the scene in a wool saleroom in Australia, and it is typical of what may be seen in England. "The sales-room in the Sydney Exchange," he says, "is not quite so large, and the crowd does not amount to 300 or more, as in London. But the excitement from the moment the bidding starts is a spectacle really worth seeing. It is sometimes known locally as the dog-fight. Half-a-dozen

A WOOL WAREHOUSE IN ADELAIDE, SOUTH AUSTRALIA

foreigners start suddenly to their feet gesticulating like lunatics. An innocent onlooker would imagine that an outrage had just been committed in the French Chamber of Deputies, and that he was watching the arrest of the criminal. All the time a huge gaunt yankee in an upper row will be bawling some monosyllable interjection with the regulation of a foghorn. Sometimes buyers have actually climbed down over the shoulders of buyers in front until they were almost leaning against the auctioneer's desk, shouting their bids straight into his face. Then the auctioneer makes a nod, the whole din subsides, and you learn that the lot has been knocked down to a quiet, spectacled Japanese gentleman in the back row who said 'three,' which means three farthings, and put an end to the pandemonium. In the matter of dog-fights," he adds, "there is little to choose between the Sydney and London wool sales."

At one time the representatives of practically every country on the globe came to London for wool, but of recent years there has been a tendency to develop more and more the wool sales in Australasia, and for some time the Germans, French, and Americans have had their own ships running direct to the Antipodes, and have chosen to buy most of their wool either in Australia or New Zealand. Many of the big Australian squatters

still prefer to market their wool in London, but the farmers and smaller men obtain their money much more quickly by selling in Australia. Owing to the fact that the large runs are being yearly more cut up by the Government and the smaller men are increasing, the Australian sales are becoming more and more popular; indeed, the markets held at Sydney, Melbourne, Geelong, Adelaide, Fremantle, Brisbane, and in Tasmania and New Zealand now deal with over three-quarters of the Australasian wool, Sydney alone having in recent years almost equalled London in the quantities of wool sold. London continues to sell a considerable amount of Cape, Falkland Islands, and other wool, but many European firms are now regularly sending their own representatives to Australia direct, believing that they thus not only reap financial advantage, but thereby obtain the pick of the clips. The biggest buyers at the Australian sales of late have been the Germans, their purchases in 1912 being 420,788 bales against Britain's 392,519. The cream of the Australian wool nowadays, however, goes to America, although Japan has recently purchased some of the highest-priced wools from Sydney.

There are also wool sales in South Africa at Port Elizabeth, East London, Mossel Bay, Durban,

and at smaller inland centres, but the bulk of Cape wool is sold privately to large merchants in South Africa. There are sales at Antwerp consisting mainly of River Plate wools, and there is usually a sale in Bremen once a year for Australian wools bought in the Colony for re-sale in that city. Some raw wool is also sold at Havre, and there are also sales of partly manufactured wool at other places in France; but the London wool sales, despite some tendency to diminish in importance, still furnish the standard prices all over the world.

It is curious to note that England, holding as it does a place so eminent in the world of manufacture, should, until recently at all events, have paid practically no attention to those details of wool production which have assuredly given Australia the lead in the world's markets. England, as we have shown, was famous as a wool-growing country centuries before many of its competitors were heard of, but latterly there has been a tendency to fall away from the best traditions and allow younger countries to outstrip her in the race.

In its excellent review of the wool trade at the close of 1914, the *Bradford Observer* said: "Our estimate of the English clip shows a reduction as compared with last year of 3,922,000 lbs., equivalent to 16,300 packs, or (say) 11,900 colonial bales.

Since 1909 there has been a steady decline in the number of sheep kept in this country, and while it is too early yet to be alarmed about the English wool production, the downward trend of the figures for the past few years is something to be noted, and it would be interesting to inquire to what extent it is due to the growth of the trade in fat lambs. Exports of English wool this year have been more than half as large again as those of last year, and there can be little doubt that but for the war they would have exceeded the big total of 1912. The United States have taken nearly three times as much as last year; Russia, France, and Holland have all bought liberally, and Germany, whose account was closed at the end of July, was the only country whose takings at that time did not come up to last year's figures."

It is perhaps something in the way of explanation of the growth in the trade in fat lambs that the home sheep-breeder has been much discouraged by the poor prices he has made for his wool; but be that as it may, he has largely overlooked the fact that he is himself to blame for the falling off in his profits on fleeces. Had he studied closely the history of the trade in Australia and some other of the younger sheep-rearing countries, he would have discovered that these far-distant places had won their positions in the markets of the world as

much by scientific methods as by natural advantages; for, after all, it has to be remembered that against certain natural advantages which are possessed by some of our colonies must be placed the difficulty and expense of transporting wool from far-away inland stations, and also of carrying the wool half-way round the world before the principal market can be reached. The English wool-grower has not only his market, but his manufacturer at his own door, and, with such excellent sheep country as he has at his disposal, there must be something radically wrong if he cannot "keep up his end" with the keenest competition from overseas.

It is curious that although the United Kingdom in 1912 had 29,000,000 sheep, or a larger number than New Zealand, none of the British wool had up to the end of that year been sold on the London Wool Exchange. The clip, assuming an average of about 6 lbs. of wool per sheep, amounts in round figures to about 180,000,000 lbs. of wool, but the whole of this is disposed of either at local markets or by private treaty. The bulk of the English wool is of the long-stapled variety, and its sale is really an important branch of trade. Representatives of the West Riding trade, and country wool-dealers, either purchase the wool from the farmers or the wool comes to market

at fairs such as those held at Leicester and Lincoln. There are regular sales of Irish wool in Dublin, and of Scottish wools in Edinburgh, or Leith, or Glasgow. Complaint after complaint has been made as to the manner in which British wools are shorn, classed, and baled, the methods of carrying out these operations, it is stated, being of the most primitive description. It is surprising that whilst Australian wools are prepared for market and sold by auction in bulk either in Australia or in London by methods which give general satisfaction, British wools were until quite recently still marketed in a manner more suited to an earlier generation than to the present day.

A comparison between the prices obtained for English wool, when marketed on the usual lines, and the prices obtained for colonial wool of a similar class on the London wool market, leads to the conclusion that the more highly organised methods adopted by the colonials in respect to classifying and packing insure a better monetary return to the growers. Enquiries made among wool-buyers in England and Wales confirm the opinion that if an improved system of classing and marketing were adopted by the home sheep farmers, it might reasonably be expected that better prices would also obtain for the home-grown product.

Some years ago an organisation was established in England which seems likely before long to put the British sheep-rearer on the direct road to success. The Agricultural Organisation Society, amongst other things, is now promoting co-operative wool societies in various parts of the country, and these have for their aim the adoption of the main features of the colonial system, namely, the classification of the wool and its subsequent marketing in large lots under brands constituting guarantees of quality.

It is the practice in the colonies at shearing to divide the inferior portions of the fleece from the main fleece by separating the belly wool and skirting off the coarse woolled britch, and the resulting fleeces, pieces, bellies, and locks (the sweepings of the shearing board) have a marketable value, but care is taken to market them separately. The fleeces, in addition to the usual division of hogs and ewes, washed and unwashed, are still further classed according to quality, and each of the classes, four in number, is packed separately and offered for sale in large lots under a brand forming a guarantee of even quality and honest packing.

Buyers claim that this system of classification enables them to offer the fullest price, as no allowance has to be made for unevenness of quality or faulty packing. The huge colonial sheep runs with

their thousands of sheep undoubtedly assist organised schemes for the sale of wool in large quantities of even quality, but the English farmers, by adopting co-operation and more systematic methods of classification, hope to be able to place themselves in at least an equal position to the colonial competitor who has had so far to send his wool to the London market.

Mr. Digby B. Grist, in an excellent paper on wool classing read at the Nottingham Conference of the National Sheep-Breeders' Association in 1915, to which I am indebted for many of the facts appertaining to this subject, stated that in 1913, as a result of the propagandist work of the Agricultural Organisation Society, sheep farmers in three districts, namely, in Carnarvonshire and in the Brandsby and Malton districts of Yorkshire, decided to deal with their clips on the lines advocated. In Yorkshire, the work was undertaken by the Brandsby Agricultural Trading Association, which sold 7,000 fleeces at the London wool market. In Carnarvonshire, a special wool society was formed and forty-four members sold 10,000 fleeces through its instrumentality. In both cases the result of the experiment was sufficiently satisfactory to induce those who took part in it to undertake it on a larger scale with the 1914 clip. The first wool to be sold in this new

way in 1914 was 93,071 lbs., sent up from Yorkshire for sale in London by the Brandsby Agricultural Trading Association. The wool realised £4,521 7*s.* 2*d.*, a result which pleased the senders, who believe that the lower and medium grades realised quite as much, if not more, and the higher grades considerably more, than local prices. The London papers reported favourably on the get-up and sale of the wool. Some of it went to France, Germany, and America, and some of it was bought by Yorkshire manufacturers at a higher price per pound than that given by the dealers who, at the same date, were purchasing wool from the farmers in Yorkshire. The actual expenses of the Brandsby scheme in 1914 (exclusive of management) amounted to £187 3*s.* 11*d.*, or approximately a half-penny a pound. The farmers, however, charged themselves an eighth of a penny more per pound, and this left a balance sufficient to cover the expenses of management and to allow a small profit to the society.

Thus it will be seen that, although the experiments in wool organisation have only been carried on over a comparatively brief period, they have been sufficient to establish the fact that the sheep-breeder may expect to market his wool upon the most favourable terms when he adopts the methods which have proved so advantageous in the case of

his competitors who send their produce to be sold in London, the world's great market for wool. There are, too, a number of other advantages which have been found to have resulted from this organisation among British sheep-breeders, and in future, through the encouraging results already attained, there will be a much larger quantity of English fleeces placed on the London market in saleable form. Three times as many fleeces were offered in 1915 as in 1914, which is in itself a proof of the benefit of the system to English flockmasters.

CHAPTER VIII

SHEARING AND SORTING

In a book of the present dimensions one cannot do more than barely outline the processes through which wool has to go from the sheep's back to the moment it is ready to be placed on the counter in manufactured form. These processes are bewildering in number to the uninitiated, as will be seen from the fact that the finishing work alone—which only begins after the cloth comes from the hands of the weaver—involves between twenty and twenty-five different handlings, according to the kind of finish that is required. A piece of fine cloth such as is used for a lady's dress requires, after spinning and weaving, such operations as perching, mending, soaping, milling, scouring, hydro-extracting, crabbing, tentering, brush-dewing, double-brushing, steaming, raising, cutting, double-brushing, second mending, dry-steaming, blowing and exhausting, cuttling and measuring, pressing, steaming-off and cold-pressing. And just as there are a large number of processes at the one end there are a large number at the other,

the preparatory stages being very many and complicated.

Nowadays, owing to its vastness and the necessity of obtaining the speediest and most satisfactory result, the trade, and the worsted trade particularly, has become highly specialised, this fact no doubt accounting in no small degree for the supremacy which has been attained by the British industry. It is possible, of course, for one concern to undertake the twenty-fold processes required to turn out a piece of fine cloth, but in practice it is evidently much more profitable for a firm to concentrate on combing or spinning or weaving, or dyeing or finishing; or, at all events, on a few of the processes rather than on the whole. On the woollen side, it is quite common for large firms to be self-contained. Many concerns not only card, spin, and weave their own materials, but also dye and finish them as well.

The wool, either "washed" or "in the grease," has to go through several preparatory stages before it is ready for the actual combing or carding, and then after receiving it in the shape of a coil of fleecy ropes, called tops, the spinner has to put it through two or three processes before handing it forward "on the bobbin" in the shape of thread to the warper and weaver. Even then it is not more than half dealt with, for, owing to the

skill and ingenuity now exercised in dyeing and finishing—many of the methods employed being strictly guarded trade secrets—the more exacting and important work in woollen and worsted cloth manufacture often comes in subsequent to the weaving stage.

One has to go far afield to see the first act in this interesting industrial drama. In England, it may be that the preliminary work is taking place in a shed attached to a lonely moorland farm, where the perspiring farmer-shepherd is to be seen wrestling with a lusty sheep, while he endeavours with a pair of antiquated shears to divest the animal of its valuable shaggy coat. Indeed, in some parts of the world the start may be on even more primitive lines than these, for in many outlandish places they do not even take the trouble to use shears at all, but simply pull the wool from the sheep's back *sans* ceremony. Sheep naturally divest themselves of their wool when the fleece becomes a burden in hot weather and the new wool begins to grow, but there would obviously be much waste in waiting for this to happen, as the wool would be rubbed off the back here and there in the pastures and much would not be recovered. It is recorded that the custom of pulling the wool from sheep's backs survived in the north of Scotland until a comparatively recent date,

but owing to the fact that sheep were not always ready to shed their coats at the same time, much cruelty was done to some of the animals, the tearing process often leaving their skins blood raw.

As the manufacturing industry became better organised, it began to be seen that the proper shearing of flocks would be much more advantageous than the haphazard system of pulling the wool. Consequently the barbarous methods of early days were discarded, and the wool was gathered regularly and systematically for the market. Later, when sheep began to be raised by the million instead of the score, and great tracts of territory were set apart for wool growing on scientific and business lines, it became necessary to devise such means of harvesting the yield as were more in keeping with the insistent demands of the times. On the great ranches of Australia, and elsewhere, it was manifestly impossible to cope with the enormous numbers of sheep on the old hand-shearing lines, and now the work, instead of being done, as formerly, by any odd lad about the farm, has become highly specialised and is a well-regulated trade run by experts.

These professional shearers in Australia are said to number something like 30,000; they are men who perambulate a great part of the conti-

nent in the course of the season, and often—at least many of their number—make journeys to Tasmania and New Zealand as well to give a hand at the shearing. While an English farm hand, using hand shears, will have done a good day's work in clipping thirty sheep, these men, with the aid of steam or electricity, will easily do a hundred. One man, indeed, has been known to shear 327 animals in the course of a nine hours' day.

The mechanical shearer, it may be explained, generally consists of a cutting wheel geared to the shaft of a small steam turbine. A comb moves in front of the cutter, effectually protecting the animal from harm. The shearing apparatus, made of brass and in shape similar to a small trowel, is held in the hand and guided over the body of the sheep just as is the ordinary wool shears. The shearing machine not only works with great expedition, but with perfect safety to the sheep.

Australia has brought the business of shearing, like that of breeding and growing wool generally, to a great state of perfection. There are single depôts in Queensland and New South Wales where an many as 4,000 sheep are sheared in a day, machinery having now taken the place of hand work, and the shearers being remarkably expert. A man's daily output can be judged from the fact

that the officially-fixed shearing rate is 24*s.* per 100, and that men who know their business can earn from 30*s.* to £2 a day. The shearers, who move on from one shearing shed to another, only work for a few months in every year. Many possess farms of their own, which they are enabled to develop by the substantial cheques earned during the short but busy season.

The scene at shearing time on a great Australian ranch is a remarkable one. The "station" is worked with machine-like regularity, and although the pace is a fast one, there is no confusion, as every man knows his own special work and the whole business is organised to the last detail. What one sees outside the shearing sheds is only an index of what is going on inside, and the whole makes up one of the busiest hives of industry imaginable. Musterers, as they are called, are constantly arriving with sheep for the shears, or driving those already shorn to their paddocks. In the woolshed the heavy thrum of the machines driving the shears goes on from daylight to dark, with short intervals for dinner and refreshments. Long lines of men stoop busily over their work, each man pausing only to let a shorn sheep go into the pen in front, and for another kicking animal to be carried from the pen behind him.

As the fleeces fall from the sheep they are

SHEARING BY MACHINERY ON AN AUSTRALIAN STATION

quickly picked up, carried away, and thrown out on tables. The wool-rollers then skirt and roll up each fleece, placing it on the sorter's table near at hand. This expert immediately classifies them and has them consigned to their respective places, each description of wool being stocked in its own particular bin. The pressers next remove and press each sort into separate bales, and on each bale is placed a brand denoting class of sheep and quality of wool. While all this is going on, tar-boys dart hither and thither as the cry of "Tar!" arises, where a sheep has been accidentally cut by the shears. The shearing at one of the big stations may take a month to six weeks, but by the end of that time the wool of perhaps 200,000 sheep will be made up into bales and most of it on its way to port.

The transportation of the wool, like everything else, has been vastly improved since the days of slow-moving bullock teams and tramp steamers. Now the squatter, in addition to abundant horse-flesh, has the latest modes of traction at his disposal, besides being adequately catered for by railway and steamship companies. The wool takes nothing like the time to market that it formerly did; indeed, it is often transported, sold, manufactured, and being worn by the people in England in far less time than it took in the old

days to convey the raw wool from the Antipodes to the London market.

In another chapter the methods of marketing the wool are specially dealt with, and therefore it is only necessary here to follow the wool after it has been received in bale at the manufacturer's premises.

It might be thought that all wool coming from the same place and from the same breed of sheep would be ready, after some little cleansing, to go at once to the spinners and weavers. But this is not so by any means. Wool calls for a good deal of preparation before it can start on its way to the actual cloth-maker. First of all, it must be "sorted," and this in itself is a process calling for great skill. How to be able to tell at a glance the length and quality of the "staple," and judge just the sort of wool suitable for a particular purpose, requires long experience and much training; for, obviously, great economy or great waste may depend upon the sorter, as well as trouble or ease in the subsequent manufacturing processes.

The work of the wool-sorter is nowadays, however, much simplified by the system obtaining in Australia and elsewhere of "classing" the wool before it is baled. The shearer himself makes a rough classification as he does his work, and after-

wards a highly-paid expert goes over the fleeces and makes the "clip" additionally saleable by division and sub-division of the wool. Each fleece contains twelve or fifteen qualities within itself, but these are often classified again into two or three times as many. The squatter finds it to his advantage to engage the most able men available for the purpose, and during shearing time often pays the expert classer at the rate of £500 or £600 a year. By classification he makes infinitely better prices in the wool market than he otherwise would, and finds his outlay in this department particularly remunerative.

There is a very pronounced difference between wool-classing and wool-sorting. The first may be defined as merely keeping the coarse from the fine, the long from the short, the heavy from the light, and the dirty from the clean; whereas wool-sorting is the breaking up of the fleece into many sorts to suit the exact requirements of the manufacturer. A sheep produces many sorts of wool in the same fleece, and, were the wool to be used just as it is shorn, the yarn obtained from it would be faulty and very difficult to work, especially in the later stages of manufacture. At the present time, when a good deal of wool is "classed," the buyer probably sorts with a particular material in view, and is not concerned with the question as to

how few or how many descriptions can be made out of the bale before him.

The sorter, a familiar figure in his long blue smock, has his quarters close to where the bales of wool are stored, and does his work with the aid of a wired screen, or "hurdle," which is generally placed in the position of an inclined desk in front of a window where the light is good. Underneath the screen an arrangement is to be found for carrying off the dust and impurities which are shaken out when the bale is first opened, and which are often a source of great danger to the sorter. Dirty wool in its raw state is frequently a great carrier of anthrax germs, and deaths are recorded yearly from this terrible disease in the wool districts of the North of England. It is stated that there is little danger in handling British or Australian wools, but in Turkey, Russia, and Far Eastern parts of the world the disease is fairly common, and the infection is sometimes carried abroad in the exported fleeces.

Although to most outsiders one part of a fleece might appear to be pretty well as good as another, it is a vastly varied thing in the eyes of the expert wool-sorter. He is able to separate the wool of each sheep into many different qualities, as we have shown, with wonderful accuracy, but often his greatest trouble is not to arrange the wool

into various lengths of staple, but how to find a means of eliminating the various "faults" and foreign substances which may be present. One of the difficulties he has to contend with is to be found in the black and grey hairs which appear, often quite unaccountably, in white fleeces, and which are not removable by the ordinary processes of sorting. So great a nuisance did these dark hairs become some time ago that the Bradford Chamber of Commerce were obliged to take steps to try to get the contamination eradicated at its source. The Chamber, consequently, issued recommendations to farmers at home and abroad not to breed from black or grey sheep, to take the greatest care to select rams from flocks as free from grey hairs as possible, and to slaughter all black and grey lambs.

Another bugbear of the manufacturer of wool, and especially the manufacturer of the finest "stuffs" used in the dressmaking trade, has arisen from the impurities which have in the past been inseparable from the baling of the fibre. Wool comes into the country from abroad in jute bags, or "packs," as they are called, and when the packs have been opened it has been invariably found that some of the loose fibre from the packing material has become mixed in the wool. If this jute by any mischance is not discovered and gets

into the manufactured piece the result may be absolutely disastrous. Being of vegetable fibre, the pullings of the packs will not take the dyes like the animal fibre. If a shred of twine or jute becomes mixed with the wool, it will often bleach white when scoured and get through any combing process and into the yarn, and finally into the cloth itself; and when a serge or self-coloured cloth comes to be dyed, these vegetable fibres refuse to take the same dye as the wool fibres, and small discoloured flecks or streaks appear in the piece. Manufacturers have to keep special girls regularly at work overlooking the cloth to pick out the burrs or jute fibres.

In America and some other countries where fleeces are commonly shorn in half-swept barns, tied up with binder twine, and rammed into coarse jute sacks, such contamination can hardly fail to happen. Even in Australia and New Zealand, where the tying of fleeces is scrupulously avoided, and sheds are carefully swept, clippings of packing thread are apt to get in occasionally. They are, indeed, found sometimes in scoured wool, and there is evidence that more care might be taken in some of the scouring establishments. The case with bales packed on the stations is different. There the vegetable fibre can only get in from the bale. When a bale arrives in England,

at the end of its long journey it is frequently found that, if one side of it is stripped, the edge of the wool which was next it is covered with scarcely visible fibres which have come from the bale, probably during dumping. Very great care is used on many stations to buy the best jute bales, and trouble is even taken to singe the inside of the bale, and fasten it with steel clips.

But, notwithstanding every precaution, the result remains unsatisfactory, and suggestions have repeatedly been made that wool should be packed in paper-lined bales. This, of course, means an added expense to the wool-grower, seeing that the manufacturer is not inclined to pay more for the raw material on the score of the extra cost for baling, and the reform has not been taken up very enthusiastically. In view of this trouble to the manufacturer, the writer was particularly interested recently in the efforts that are being put forth by a London firm to produce a wool pack of very strong woven paper cloth, and already the pack has been tried and found to answer admirably. It is claimed for it that it will stand the strain of package and that no deleterious fibre can be rubbed off and mixed among the wool. And even if any of the paper did get among the wool, it would have no ill effects, seeing that it would take the dyes quite as well as any

wool. The Textilite Engineering Company, which makes the machinery to weave these paper packs, has also been able to evolve a process by which the paper is waterproofed while being spun on the spinning frame. This procedure not only makes the yarn water-resisting, but furthermore increases its strength, and gives to the yarn a flexibility, or rather elasticity, which has never been attained before in paper yarn.

Experiments carried out by the Bradford Wool Dyers' Association three or four years ago proved that these paper packs gave very good results, but since that time vast improvements have been made in their manufacture, and they were brought to a high pitch of perfection at Calcutta two years ago by Mr. George Seaton Milde, the managing director of the Textilite Company. The users are well satisfied with the paper pack, but argue very strongly that it is hardly possible to make much progress among the growers unless the buyer will share in the extra cost it entails. They take the view that the matter would be settled once and for all if the trade would submit to a charge for the wool packs, especially as the buyer has the option of regulating the price of the raw material.

CHAPTER IX

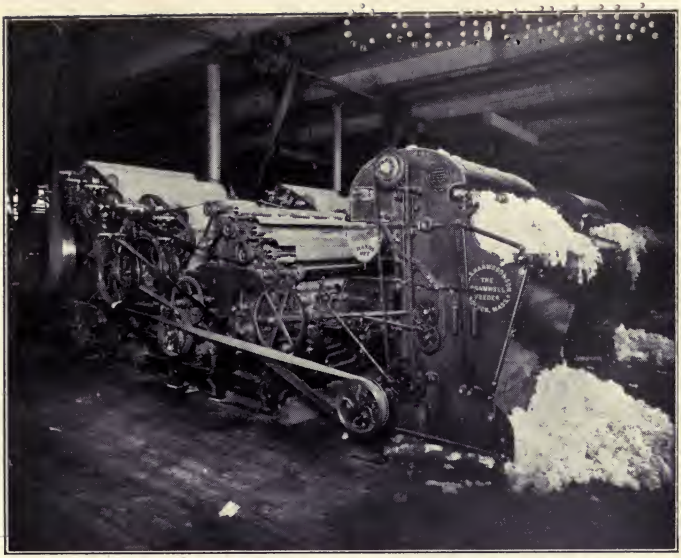
PREPARATION AND MANUFACTURE

Wool, in its natural condition, is coated with a greasy, fatty substance called the "yolk," which is more or less washed out in the course of cleansing the fibre of the impurities the fleece has gathered while on the sheep's back. A warm and slightly alkaline bath is used for the removal of the dirt, but this bath not only removes the foreign matter, but the natural grease as well, which would be most valuable if it could be retained. Indeed, as a well-known manufacturer remarked to me, a fortune awaits the person who can thoroughly cleanse the wool without removing all this fatty substance, for a certain amount of grease is necessary for the subsequent manufacturing processes. At present, the deficiency has to be made up by sprinkling oil on the washed wool.

The process of washing is interesting in itself. The wool, blended in accordance with the customer's liking, arrives first at the washing or scouring machine. It is conveyed by a travelling

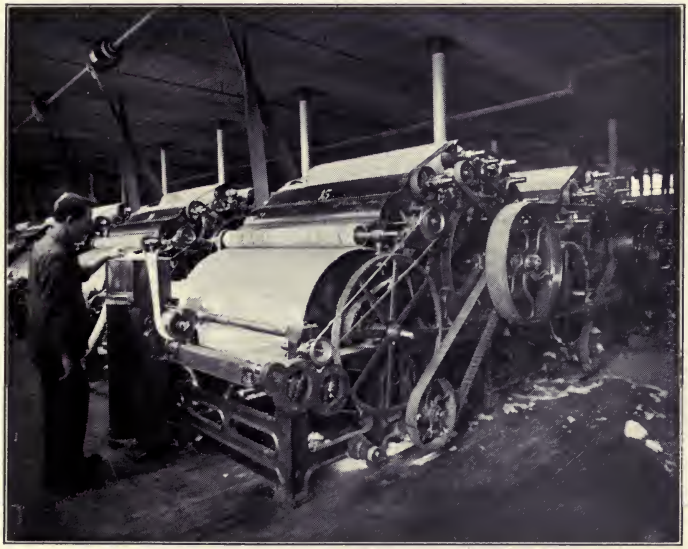
apron into the first "wash-bowl," or trough, and is carried forward by the periodical advance and recession of iron forks, one step at a time, until it is led ultimately into squeezing rollers, from which it emerges perceptibly cleaner and almost dry. The process is repeated, and the material arrives with a minimum of disturbance and dishevelment at the last bowl.

Although remarkably cleaner, the wool has not inevitably lost all its sand and vegetable adherents, but these are lessened upon the machines known as "cards," which are fitted with large cylinders. These cylinders are themselves furnished with bent wire teeth, and the minor cylinders working upon their circumference are fitted with the same in different degrees of fineness, sharpness, and strength. After teasing out the wool into a filmy veil, thus freeing it from all the sand and many of the vegetable burrs, the carding engine eventually brings the filaments together, and these, passing quickly through a funnel, form a rope or "sliver" sufficiently coherent to undergo subsequent treatment in this continuous form. The wool passes to the backwashing machine to be washed free of any impurities which may still sully its colour and to be dried continuously in a compact hot-air chamber. The material is oiled by measured drops of the best olive oil as it passes



CARDING MACHINE, SHOWING AUTOMATIC FEEDER

(Copyright by American Woolen Company)



CARDING MACHINE, SHOWING THE CARDED WOOL

(Copyright by American Woolen Company)

through a "gilling" machine designed to straighten the fibres of the sliver preparatory to their passage into the comb.

Only after this sequence of preliminary processes does the wool intended for worsted manufacture enter the machine which combs out the short and weak fibres and the remnant of vegetable impurities and divides the wool into two parts, "top" and "noil." The former is the long wool with all its fibres parallel, which constitutes the raw material of the worsted spinner. The noil, or short wool, is invaluable for making blankets, flannels, tweeds, and other woollen cloths. The separation of long from short is effected normally upon a Noble comb, fed with carded sliver supplied from balls set around the circumference near to the ground. The carded wool is led upwards through conductors, and thus to the pins or teeth of an annular comb rotating in the horizontal plane. This is the comb called the large circle, inside of which revolve two smaller circles furnished also with pin teeth. At the points of contact of the outer with the inner circles dabbing brushes work vigorously up and down to press the uncombed wool into the teeth. The wool overhangs the edges of the circles and is engaged and combed by the passing teeth. The long fibres are drawn off, leaving the short or noil

fibres within the pins. The top is carried off upwards and is coiled away and the coil cleared out of the pins is passed downward. The operation is not over until the combed top has been passed through a "finisher" box, in which the sliver is made equal and uniform in all respects and has restored to it the moisture lost in the preceding operations.

The business of wool-combing is almost exclusively a Yorkshire one, and the last Home Office return showed that of the 2,924 machine combs in the kingdom 2,642 were in Yorkshire. The Yorkshire combs are all in Bradford or a short distance from that city. To a large extent, the general success of the wool-using industries of this kingdom are dependent upon the wool-comber's work. The operation of combing is a fundamental one upon which all subsequent results are built, and there is everything to be said for having wool combed in the most economical and accomplished manner. It is claimed that nothing is wasted by the wool-comber. The suds from the washing machines after they are spent are run into tanks, where the wool grease is separated from the water by vitriol. The fat thus recovered is pressed under heat in modern machinery built for the purpose. The fluid oil is run off and casked to be sold to America or elsewhere for axle-grease. The press

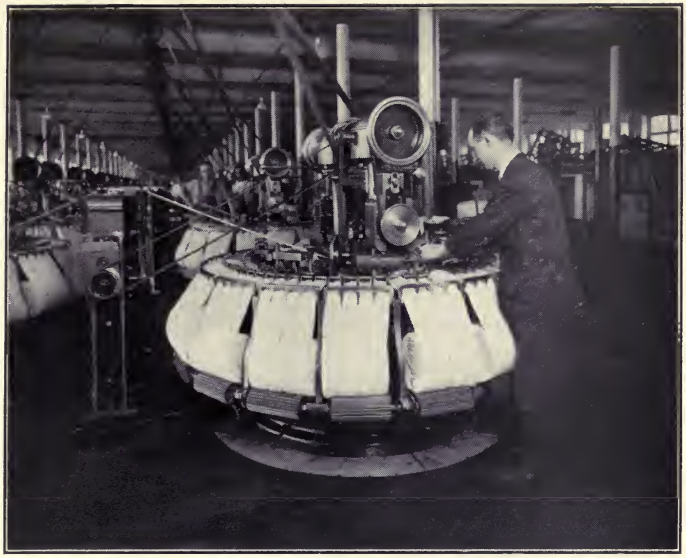
cake remaining behind makes a valuable manure much used in Continental countries. The burr-dust and sand picked from the teeth of the cards is saved and sold for shipment to France.

The process for woollens is different in the preparatory stages, the aim being to turn short wool into relatively thick yarns and cloth, and not long wools into fine fabrics of thin texture, as is generally the case with worsteds. As I have already pointed out, the essential difference between the two is that the wool for worsteds is combed, and that for woolens is carded. The latter is washed in much the same way as the former, and after being thoroughly blended is taken to the carding machines which are made up of rollers or cylinders, all densely covered with fine bent wire, and having much the appearance of a rough hairbrush. The function of these cylinders is to separate the fibre so minutely that before the wool reaches the final roller of the first machine it is spread in an even film over the whole surface. It is then combed off the wires in an unbroken sheet, so thin as to be transparent. These carding machines, with their automatic feeders and arrangements for weighing and even distributing the wool, are marvels of ingenuity, and quite uncanny in their modes of operation. First of all, they will take the wool, lock by lock,

from a bin, and drop it into a pan which extends across the machine. When the pan has received a stated weight, the apparatus will halt and wait until the pan tips over and spreads a uniform load of correct weight right across the feed-sheet of the machine. After timing the operation to a nicety, it will with unerring precision start again and repeat the process, doing the work much more evenly than is possible by means of human agency.

With the object of obtaining a still greater uniformity the film of separated fibres is taken to a second carding machine, and the wool comes off the wire-covered rollers in this case with surprising evenness. In the card, called a "condenser," the wool is delivered in a series of rings, and these soft ropes are then sent forward to the spinner.

Spinning is the art of twisting fibrous substances into rounded strands of yarn fitted for weaving. To form such strands two operations are essential—the drawing out of uniform quantities of fibre in a continuous manner, and twisting the material so drawn out to give it coherency and strain-resisting power. Both weft and warp have to be supplied by the spinner, but a word of explanation is necessary as to what constitutes the one and what makes the other. The yarn first spun on to spools is soft and fragile, and is only suitable for weft—that is, to be put as a cop in the



ENGLISH COMBING MACHINE
(Copyright by American Woolen Company)

SPINNING FRAMES AT WORK
(Copyright by American Woolen Company)

shuttle and thrown lightly across the piece in weaving. Warp threads must be of a different quality altogether, and able to bear much greater strain. This is got by giving more twist to the yarn, and worsted warps are often composed of two single strands twisted together. For this operation a special frame called a "twister" is required. The yarn thus twisted has naturally a much better weaving value, and is frequently used for weft as well as for warp in some of the best serges and other worsted productions.

There are four types of spinning-machine—flyer, cap, ring, and mule. The flyer, according to the "Wool Year Book" classification, is used for hair, lustre, and low cross-bred wool yarns; the cap for the finer cross-breds and merinos; the ring for the softer and smoother yarns of the finest merino qualities; and the mule for those yarns of the shorter material, such as fine dry-spun dress and hosiery yarns, in which special features of softness and fulness are required.

The continuous, or "throstle," frame has been adapted to woollen spinning, but its use is decidedly limited, and the mule is still by far the most popular spinning-machine for every class of woollen thread, whether it be made of pure wool or shoddy.

The series of inventions which overthrew hand-

spinning were begun by Lewis Paul in 1738, when he patented the important principle of drawing out and attenuating a "sliver" or loose coil of fibre by passing it between successive pairs of rollers revolving at increasing rates of velocity. The principle of drawing out fibres by accelerated motion was in the spinning frame or "throstle" invented by Arkwright in 1767, and it forms a fundamental feature of all modern spinning machinery.

The wool after combing or carding is in long fleecy ropes, and it is, of course, necessary that this "sliver," as it is called, should be greatly reduced in size before it can be used for either warp or weft. In order to accomplish this, the "sliver" is passed through a series of machines, or "boxes," the function of which is to extend the wool by drawing it out by means of groups of rollers. It is afterwards twisted slightly until it resembles loosely-twisted rope and then wound upon large bobbins. The reducing process is continued on other machines, and by the same means, until what was at the beginning a thick uneven coil becomes a series of thin, smooth threads. The drawing, briefly, is accomplished by rollers, and the twisting and winding-on by means of spindles.

The spinning and winding of the threads on the

bobbins in the later stages is exceedingly interesting. The working of the "mule" is especially so, with its moving carriage to draw or extend the threads, and the curious action of the stationary stand of rollers paying out the condensed thread just so fast as it can be dealt with by the moving carriage and the spindles. The filling of the spindles and bobbins, too, is fascinating. By an exceptionally complicated series of wheels, cones, and belts the speed of the bobbin alters continually as it fills, and it winds on the wool at uniform tension throughout the whole process.

Although it is now possible automatically to "doff" the full bobbins of spun thread from the spinning frames and slip empty ones on in their places, the work is still done by half-time children in a great many of the mills in the North. These youngsters, as lively a lot as can be found in the length and breadth of the land, are wonderfully adept at their work. Ten children, for instance, will change a frame of 200 bobbins within half a minute. The work, notwithstanding, is not very arduous, and the youngsters get long spells of leisure while the bobbins are filling up again. No sooner have they finished emptying a frame than they are out at play in the factory yard to be recalled by the shrill whistle of the overlooker when wanted. The "doffer," generally regarded

as the most mischievous young imp alive, is described by Edwin Waugh, the Lancashire poet, as—

". . . . a lively cowt,
Keen as a cross-cut saw;
Short yure, sharp teeth, a twinklin' e'e,
An' a little hungry maw!"

After spinning, a number of interesting preliminary operations are required before the actual weaving can be started upon, including warping, sizing, beaming, healding, and sleying the yarn. Warping consists in bringing together and arranging in parallel order and in uniform length the number of threads which are required for the breadth of web to be formed. Sizing, or dressing, is an operation in which the warp yarn so assembled is treated with a glutinous or pasty compound to give the threads increased compactness and tenacity. Beaming consists in spreading the warp uniformly over the warp-beam, and in rolling it around the beam in a regular manner, keeping the threads parallel and in straight order. Healding, or "drawing"-in, is the most important of all operations in loom-mounting, or indeed in weaving, for on it the whole nature of the weave depends. After being drafted through the healds, the warp is passed between the splits or dents of the reed, and it then only remains to carry the

warp over the breast-beam, attach the ends to the piece-beam, and the operation of weaving may be begun.

Weaving is the process of making cloth by means of interlacing warp and weft threads. In the simplest operation of weaving it is necessary to pass one set of threads transversely through another set, divided into two series, working alternately up and down, so as to receive the transverse threads in passing and interlock them, forming thereby a united surface. The hand-loom was made to assist the early weaver in this operation, and the power-loom, with manifold devices for operating the warp and weft, later on enormously increased its efficiency. Indeed, the loom has now attained that swiftness and certainty of action, and that power of producing variety and quality of work, that it may be said to be one of the most marvellous of all mechanical combinations.

Three very important movements have to be observed in weaving—what are known as shedding, picking, and beating up. First of all, after the warp threads have been made to be absolutely parallel, there must be a method of lifting every end, or group of ends, under which it is desired to thread the weft; there must be some means of threading the weft through this open "shed" of

the warp; and after the operation of the shuttle every strand of weft must be closed up to the one preceding it in order that the cloth may have a firm, close texture. The first essential of arranging the warp is accomplished by means of winding the warp round a beam, a method which makes it possible to have a warp of practically any length and width. It is common to find nowadays warps hundreds of yards long, many yards in width, and composed of thousands of ends. Most "heavy woollen" looms, indeed, have very great width, making those one finds in cotton mills seem toys by comparison. The looms on the worsted side, however, are smaller and lighter, those employed for the weaving of stuff or dress goods being little different from the machines in use in the Lancashire cotton industry.

To accomplish the second movement—the dividing of the warp into two portions by means of lifting the threads, in order to insert the weft—the ends of the warp are passed through a deep comb of long straight reeds, which allow the threads to be lifted up easily and still kept well apart. In order that the warp threads may be lifted with precision, they are passed through tiny loops of string, known technically as healds, and these healds are controlled by means of tappets in the case of small patterns and by harness cords

controlled by what is known as the jacquard machine in the case of larger and more fancy patterns. When the healds are properly adjusted and the alternate attachments made, the warp threads can be opened and closed at will in order to accommodate the sharp-nosed shuttle in its passage backwards and forwards across the cloth. By alternating in various ways the lift of these healds, it will be seen that many kinds of weave—many varied arrangements and interlacings of warp and weft—are possible.

The whole process of making a compact web, however, is not finished until the long line of reeds has been pulled forward and the weft thread beaten up tightly against the thread immediately preceding it, in order to form a close and even texture. Formerly this beating up was a manual operation in the old hand-loom days, but now the reed and the frame to which it is attached is made to work backwards and forwards from the cloth automatically after the passage of the shuttle with the weft.

In the old days to which we refer, the hand-loom weaver had his hands very full. To keep the loom going he was required to throw the shuttle across with one hand, pull the reed towards him with the other, and with both feet he had to work treadles which alternately opened and closed

the warp threads. Before Kay's invention in 1733, it even required more than one hand to manipulate the shuttle on a broad loom, and the process must have been at that time a particularly tedious one. The object of the inventor of the power-loom was to co-ordinate and make automatic all these processes, but the task, simple though it may appear nowadays, was not accomplished without endless worry and trouble on the part of inventors, and even then success was not attained until well into the nineteenth century.

The weaving of woollens, does not call for very complicated mechanism, being chiefly plain, substantial cloths, but in worsted cloth-weaving, in which variety is most desirable, ingenuity is taxed to its utmost. With two shafts of healds in the loom only a plain web can be produced, with three shafts it is possible to weave a simple twill, and from this point upwards the possibility of combination and variation increases enormously. Coloured patterns may be produced by employing warps of different colours, and these patterns may be still further diversified by employing a number of shuttles each carrying a differently coloured weft.

With every additional shaft, as already pointed out, the designer gets more elbow-room, but, as the possibilities of the ordinary heald shaft were

WEAVING ON THE OLD HAND LOOM

(Photo by Mr. J. W. Smith, Darwen)

distinctly limited in number, other means had to be found of operating warp threads in the interest of "fancy" weaving. By means of an attachment known as a witch or dobbie frame, it became possible to manipulate about forty-eight sets of healds, but this arrangement was in turn altogether eclipsed by the wonderful jacquard apparatus, invented in 1801 by Joseph Marie Jacquard, a native of Lyons. The famous Frenchman was spurred to action by the offer in an English paper of a premium for a machine for weaving nets, and when the invention appeared it effected a complete revolution in the art of weaving, especially in figured fabrics. It was an apparatus which could be adjusted to almost every kind of loom, its office being merely to direct those movements of the warp-threads which are required to produce the pattern, and which previously were effected by the weaver's fingers.

In the common weaving process the warp threads are each passed through a small loop in the lifting thread, so as to be raised by means of the treadles, which act directly upon the lifting bars. These lifting threads in the jacquard apparatus are attached to certain wires, ending in hooks, which are caught and raised by each upward motion of the lifting-bar. The arrangement for controlling the threads consists of needles acted

on by holes in a card cylinder, the idea being practically that of the perforated card in a musical box. There are, however, many kinds of jacquard machines, and some are highly technical and extremely complicated. Suffice it to say that the great invention not only obviated the tedious task known as "tying the harness," but made it possible for the most varied and intricate patterns to be woven with almost as much ease and rapidity as a piece of plain cloth.

It is interesting to note that the great genius who gave to the world the jacquard machine had to meet just the same kind of persecution at the hands of his fellow-workmen as the Englishmen who completely revolutionised spinning and weaving, and, like them, the Frenchman had the mortification of seeing his handiwork smashed to pieces by enraged mobs who fancied that their means of livelihood were jeopardised by the new invention. Jacquard's countrymen made amends later on, however, for on the exact spot in Lyons where his first completed machine was wrecked, they long years afterwards erected a splendid monument to his honour.

It should be added that of recent years the Bradford manufacturers have shown an increasing disposition to adopt the automatic loom for the plainer kind of goods, the well-known North-

rop invention having been installed in many places. This loom, which is the product of a Keighley man resident in America, feeds itself with weft automatically, and has a warp stop mechanism whereby the loom stops simultaneously with the breakage of a thread. It is marvellously constructed, and as it is likely to come more and more into vogue, especially as the latest models are being adapted for dobby and jacquard work, a few details will no doubt be of interest.

Northrop loom improvements come under two heads, those of weft-changing mechanisms and warp-stopping devices. The weft-changer increases production per weaver. The warp-stopping device does so to a small extent, and the combination of the two results in utilising labour to double the advantage which would be obtained by the sum of the two used separately. The facts, therefore, present this curious anomaly: A good weaver on small plain looms has a capacity of two to four looms; on the same looms with warp stop-motion, a capacity of possibly five or six looms; on looms with the Northrop weft-changer alone, a capacity of from eight to ten looms; on looms with the Northrop weft-changer and warp stop-motion, a capacity of twelve and upwards, according to the class of cloth woven.

With the ordinary loom, when the weft in the shuttle is exhausted, the loom is automatically stopped, and a certain amount of product is thereby lost. The weaver then goes through the following operations: Releases the brake, pushes the sley back, withdraws the shuttle from the box or shed, puts in the reserve shuttle, operates the spring handle to start the loom, takes up the empty shuttle again, pulls the shuttle spindle out at an angle, removes the exhausted bobbin—or, in the case of cops, the cop bottom—replaces with a new supply of weft, pulls off a sufficient length of weft from the weft-carrier, snaps the shuttle-spindle back into place, holds the end over the eye entrance with the finger, sucks the weft through the hole, and inserts the shuttle in its receptacle, where it remains until needed. In comparison with this series of operations, the weaver on a Northrop loom does not have to come to the loom every time a new supply of weft is necessary, but at infrequent intervals can take bobbins or cops from a convenient box, pull off a sufficient length of weft, apply the bobbin to the hopper notches, or skewer the cop and apply the skewer to the aforesaid notches, and wind the thread on the hopper-stud with a simultaneous movement.

When a warp thread breaks on an ordinary

loom the machine continues running. The broken thread not being operated by its heddle is not raised for the shuttle to pass under, and it thereby falls below the cloth, leaving an open space which is more or less visible to the eye, according to the character of the cloth woven. Before dropping, however, this broken end, extending from the cloth in the direction of the warp, can very easily get tangled around adjacent warp threads, making a "net," and spoil several inches of cloth. The weaver must then stop the loom, loosen up the cloth from the cloth-roll, pull the temples back and "pull back." In many mills it is made obligatory for the weaver to stop her other looms during this operation. After the pulling back process the warp-beam must be turned back, the tension of the cloth adjusted, and the loom set in motion again.

It does not seem to be mechanically feasible to insert a supply of weft in a flying shuttle, which expels an empty carrier at the same time and guides the new thread past several detaining projections into an angled passage-way. Were this feat accomplished with the shuttle and sley at rest, it would be sufficiently surprising; but when we consider that the new weft-carrier is inserted instantaneously with the shuttle barely across the sley, and with the sley itself moving in a direction

at right angles to that of the shuttle, the difficulty of the problem may be realised.

In the Northrop loom the weft-carrier takes the form of either the usual bobbin or cop-skewer, with the difference that each has large metallic rings applied at the head end which serve to engage notches in a forked spring which is secured to the shuttle body. The bobbin or skewer is held in a circular hopper by suitable pockets, which have a rotary movement to bring them successively into proper operating position. The end of the weft is extended from the carrier and wound around a stud. When the ordinary weft-fork detects absence of weft at the opposite end of the loom, a rod is turned, which puts a transferring device into operative engagement with the advancing sley; at the same time a detector finger reaches forward to ascertain whether the shuttle is in proper position to receive a fresh supply. If everything is all right, the transferrer—shaped something like a hammer—presses a fresh supply into the open top of the shuttle, pushing the spent carrier out through the open bottom of the shuttle, down into a receptacle.

If the shuttle does not reach home, or should it rebound too much, the shuttle-position detector will not allow the operation. As the sley turns back, the shuttle is thrown across the loom and

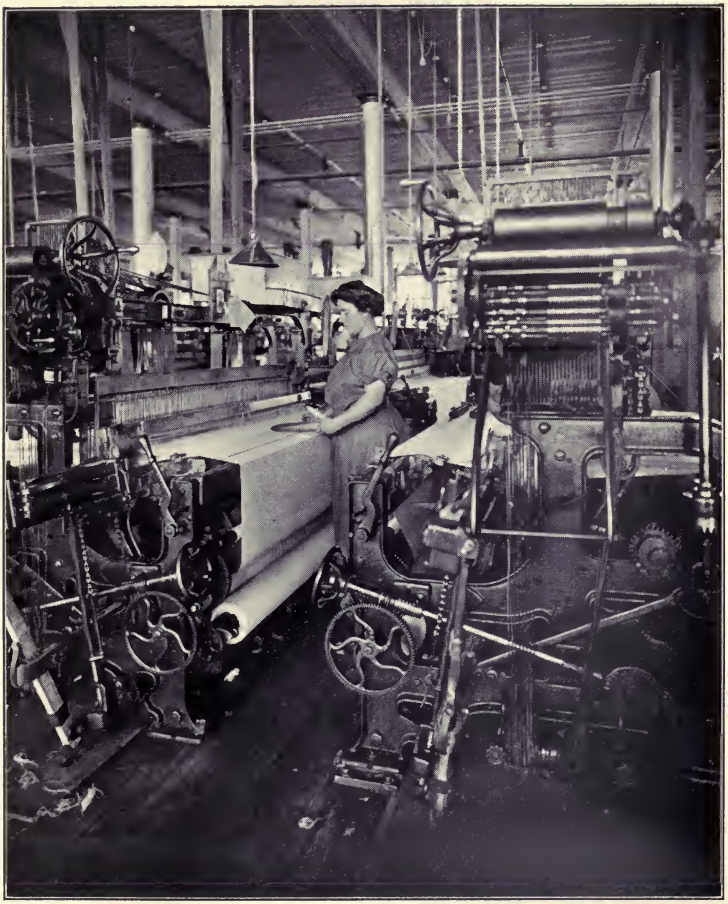
the thread unwinds from the carrier, entering a slotted passage-way in the shuttle-eye. The sley then beats the weft up and operates a cutter attached to the temple, which severs the end of weft which extends from the cloth to the stud before mentioned. When the shuttle is thrown back, the weft is led into the side-eye from its new position in the cloth, and the ordinary operation of weaving continues. Should the shuttle fail to thread or "misthread," or should there be no weft supply transferred for any reason, the loom will stop through a device actuated by repeated failure of the weft-fork.

On an ordinary loom the operative is for the most part engaged in the detection and repair of broken warp threads, which, together with the constant shuttling of weft on three or four looms, occupies the weaver's time and energy to its utmost limit. But when a loom is fitted with the Northrop automatic device for the replenishing of weft, then the operative's work is appreciably reduced by its being simply necessary to attend to the broken ends alone. The warp stop-motion, however, is an essential adjunct to a loom having mechanical means of replenishing the weft, because it is required that the operative shall manage the maximum number of looms, and to attain this, provision must be made whereby a broken

end is at once detected and the loom automatically stopped.

Briefly described, the warp-stop motion on a Northrop loom consists of a thin steel drop wire some 3½ inches in length, suspended by a warp thread passing through a round eye in its centre, and having a slot above, through which is passed a flat bar keeping the drop wire in position in the warp stop-box. At the bottom of this box is a serrated vibrator moving with a reciprocating motion from a simple eccentric on the tappet shaft. The breaking of the warp thread allowing the detector to fall in the path of this vibrator at once puts in action a knock-off finger in contact with the starting-handle. Immediately an end breaks the loom stops; therefore the weaving down of several ends and consequent floats are at once avoided. The operative is relieved from all mental anxiety, and is not required to be constantly on the look-out for broken ends.

Another very successful automatic loom is of Swiss origin, and bears the name of the "Steinen." The weft replenishment in this case is effected by means of electricity, and the threading of the shuttle is done by the aid of compressed air. A useful feature of the loom, which has proved exceedingly reliable at work, is that whenever it



AN UP-TO-DATE WEAVING SHED

(*Copyright by American Woolen Company*)

stops through either weft or warp breakage, or any other reason, a small electric lamp is immediately lighted to call the attention of the weaver. It will be readily seen how useful this device is when it is stated that in many of the Continental cotton mills in which it has been installed only three attendants are required to look after a hundred looms.

With these advantages, it might be regarded as remarkably strange that the automatic loom has not been more generally adopted in the woollen trade. It should be explained, however, that to install these looms, which are naturally much more costly than the ordinary ones, involves a very heavy capital outlay, and, further, many are loth to part with looms which are doing their work so well. The automatic loom, it is contended, neither works so steadily nor with such precision as the plain loom, nor is there much advantage to be gained when the speed, the number of thread breakages, and the amount of tackling are fully taken into consideration.

Many other inventions for improving or speeding-up weaving might be mentioned, and notably the circular loom, which allows of many shuttles filled with differently coloured wefts being kept continually running, but few revolutionary de-

vices have been adopted. For cloths intended to be woven carefully and beautifully finished the manufacturer prefers to stick to his old and tried friend the plain loom, where personal supervision can be exercised to the fullest extent.

CHAPTER X

FINISHING PROCESSES

Perhaps the finishing of a piece of cloth is as interesting an operation—or series of operations—as any to be found in the whole factory. First, as regards the more complicated "worsteds," the cloth passes inch by inch under the microscopic inspection of young women specially trained to the work. Knots are cut off where broken yarns have been joined together; any slight disorder of the threads is reduced to order; with needle and thread defects are made good so as to defy detection. In short, the human hand is summoned to remedy the faults and imperfections of the work of what is generally deemed to be the most perfect of all mechanism. The cloth must then be washed, for it has been stained with numerous grease spots in its passage through the loom. After washing, the piece may perhaps be "milled," which is the technical term for the pounding and hammering which the cloth receives while still saturated with soap, the effect of which is to close up the fibres and shrink the cloth to the requisite width. Milling increases also the strength of the

cloth, and enhances its wearing value by forcing the fibres into the closest relation.

It would be too tedious to enter into any description of the remaining processes—how a nap is raised on the surface by teazles; how the cloth is steamed, stretched and brushed, cropped by a very fine machine acting on the principle of the lawn mower; how it is then pressed between hot plates, and dry-steamed to impart a bloom, rolled into the piece, and lastly sent to the piece room, where it is again inspected, measured, and then packed for transport. Nothing, indeed, is more striking in the whole scope of the worsted manufacture than the change of appearance between the time the cloth leaves the loom and enters the piece room.

It can readily be seen that a piece of cloth can be either made or marred in the finishing, and nowadays the work, in which the dyer and designer co-operate, is raised to a very fine art. Only the bare rudiments of finishing are given above; in the case of the finest and most attractive dress materials many other cunning processes may be gone through. It is not an uncommon thing, for instance, for cloth to be raised and cropped two or three times in succession, and many fabrics, such as beavers and meltons, are often milled over and over again.

Dyeing is, obviously, one of the most important of the processes. Formerly, nearly all woollen goods were dyed after leaving the loom; nowadays, the practice is becoming more general of dyeing the yarn previous to spinning. This mode of procedure insures that absolutely accurate shades of colour can be guaranteed or always reproduced. The tailor may therefore cut a coat and vest from one piece and the trousers from another, without any fear of the slightest variation in colour being perceptible—an immense convenience and economy which a layman may not fully appreciate.

Until about fifty years ago, writes an expert in *The Times* Textile Supplement, the whole of the dyes used were obtained from natural sources, and were comparatively few in number, those of much importance not exceeding a dozen. Amongst the most important were indigo, logwood, fustic, cochineal, and orchil. The production of synthetic dyestuffs originated in England in 1858, when Perkin discovered the "mauve" with which his name will ever be associated. The industry has been mainly developed in Germany, and there are now on the market upwards of 2,000 different chemical products which are used as dyestuffs.

The dyeing processes required in the fixation of different dyes vary according to the chemical and

other properties of the dyes. Some are ready-formed colours, and dye either without addition (direct dyes) or with addition of acid (acid dyes). Others are ready-formed colours, but, being quite insoluble in water, they must be chemically treated (reduced) before they can be fixed upon the wool. These are the so-called vat dyes, of which indigo is the best-known example. Another most important group are the mordant dyes, which are not complete colours in themselves, but must be chemically combined with some metallic salt before the actual colour is produced. The direct dyes are applied by merely boiling the wool in their solution for about an hour. The acid dyes are similarly applied, with the addition of a small amount of sulphuric, acetic, or formic acid. The insoluble vat dyes are induced to form a solution by combining them with hydrogen, this being supplied by the action of ferments, as in the "woad vat," or by chemical reducing agents, such as hydrosulphite of soda. An alkali is also required to dissolve the new compound formed. The wool is saturated with the warm solution and then exposed to the air, when the reverse change takes place and the original insoluble dye is "reproduced on the fibre." In applying the mordant dyes two operations are usually necessary, the wool being first boiled with a solution of the

metallic mordant—usually bichromate of potash—and then in a separate bath the "mordanted" wool is boiled with the dyestuff, when the colour is formed on the fibre.

Many minor modifications of the above processes are required for the successful application of different members of any of the groups. The requisite "fastness" of dyes has also to be carefully studied. For example, says the expert quoted, it is much more important that dyes upon materials used for window curtains should be fast to light than they should be fast to washing, whereas in material used for underclothing the relative importance is exactly the reverse. Modern dyeing, therefore, makes great demands on skill and knowledge, and the most successful dyer has generally had an all-round technical training to fit him for his work.

One of the most serious problems which arose out of the war was in relation to dyewares, about 80 per cent. of which had hitherto come from Germany. The war brought home to our textile industries the extent of the monopoly which the Germans had acquired as suppliers of dyewares, not only to this country, but to users in all parts of the Old and New Worlds, for on the one hand prices rose from 100 to 400 per cent., and on the other hand supplies came to an end in a very

short space of time. Owing to the impossibility of getting certain colours, shade cards which had been sent out by the Bradford Dyers' Association before the war broke out had to be recalled, and after consultation with merchants a revised card of more sombre tones was issued. Even so, the supply of dyewares, particularly bright colours, was an awkward problem, for in some colours all the dye available was mortgaged for work contracted for, and this, of course, was very quickly exhausted. The dyewares position, which had been so seriously imperilled by our easy-going system, began at once to engage the attention of users, and a scheme was set on foot to establish, with Government assistance, works for the manufacture of dyewares in this country.

Hand in hand with the dyer and finisher must go the designer of cloth, if the finished product is to be an artistic success. And to the designer must undoubtedly be given much of the credit for the beautiful productions that are to be found in England at the present day. While the majority of the home manufacturers are remaining staunch to the British tradition for purity and excellence, the English designer in both sections of the industry is winning the world's approval by the beauty and variety of his work. Even the French artists in dress goods find that those en-

gaged in the "Bradford trade" are running them very close both in style and finish, while Huddersfield often has cause for complaint that its designs in fancy worsteds are greedily pirated abroad. The designer's art has, indeed, become something to marvel at. As one Huddersfield expert, with legitimate pride, puts it: "The up-to-date production of a first-rate mill should more aptly be described as a 'creation,' a tone-picture with cloth for the canvas, for in it is the designer's personality just as surely as any painter's, and no bald definition such as a 'brown stripe suiting' or a 'smoke trousering' can possibly give even an approximate idea of the beauty of contrasted colouring, the tricks with silk-twist, silk, rib effects, and the livening of the whole by cunningly commingled double-twist fancy over-checkings. The designer's art has reached a stage which even ten years ago would have been deemed unattainable. Thanks to modern facilities in spinning and dyeing, and spurred along by an ever-increasing competition, cloth construction is at the present time one of the most highly-advanced arts, and gives to the world the most beautiful products."

The designer admittedly has done much, but his efforts would have been of little avail had not the North Country machine-maker kept well abreast with him and with workers in the other

branches of the trade. It would be a mistake to imagine that invention has been at a standstill since the giants of the latter part of the eighteenth century passed away. The brains in the machine-shops of Keighley, Rochdale, and other towns have been constantly on the alert, and thousands of devices have been introduced to improve the machine and stimulate production. And it is not only upon the spinning-frame and the loom that the mechanic has exercised his ingenuity; perhaps if a verdict had to be given as to which departments had benefited most by inventions during the past half century it would be on the sides devoted to the processes of preparation and finishing. All the business of washing, scouring, and drying wools was not so very long ago done by hand; now the great washing machines with their automatic forks and the hot-air suction chambers for drying purposes have absolutely revolutionised the early stages of the work, while the antiquated and leisurely "mill-bottom" processes have nearly all vanished in favour of more rapid, economical, and efficient methods. With the advances made in the spinning and weaving departments, it became necessary both to prepare the wool and finish the cloth more speedily, and this could only be done by putting aside the lumbering old wooden contrivances of an earlier

day. There is only one really important thing in the preparation stages which has not yet been accomplished, and, as previously pointed out, a big fortune awaits the man who can surmount the difficulty. It concerns the problem as to how wool can be washed without extracting the natural grease. At present, the fibre has to be scoured of its grease to cleanse it, and then it has to be slightly greased again to work it.

An instance may be given of how the machine-maker has more than once saved the situation. Some thirty years ago Bradford found itself in a most unenviable position, nearly the whole of its trade having been filched away by the French. Its hard-headed citizens tried every device they knew to woo back fortune, but to no purpose. As a last resort they decided upon an exhibition, wherein they would be able to put before the world evidences of their skill and workmanship, and called together a great company for the ceremonial inauguration. Men with eloquent and persuasive tongues drew attention to the beautiful and cunningly-wrought fabrics for which the city had been famous, and hoped thereby to make slaves of all the merchant princes. When, however, the orators had made an end to their tale, up rose a man they had scarce reckoned with—a neighbour whose fame in machine construction was world-

wide. "This display," he said, in effect, "is fine, and the talk finer, but your labour is useless so long as you continue to follow your ancient devices. You might as well try to sweep back the ocean as endeavour, with your old gear, to compete with the machines I am supplying to France." Bradford saw at once where its weakness lay. It quickly began to put its house in order, with the result that it finds itself to-day at the very top of the world's trade.

CHAPTER XI

THE EXTREMES OF WOOLLEN PRODUCTION

HITHERTO only the manufacture of the main or medium class of goods—the kind of cloth which is worn by the middle and upper artisan class, and the flannels, blankets, and so forth, which are in general use—has been discussed. There are, however, two extremes in the clothing trade—shoddy and hand-made—which are deserving of special attention, the last named being the genuine article, and the former made more or less of wool. Indeed, what is known as "shoddy" may be all wool; it is often only of inferior quality because it has been previously manufactured, but hand-made goods are, for a sufficient reason, nearly always made of the purest material. That reason is, that if the hand-spinner attempted to mix his wool with shoddy he would come to grief; he must have sound, long-fibred wool. Consequently, a buyer of home-spun cloth can assure himself that he obtains what he pays for. Of course, there are any amount of machine-made imitations of Harris and other Scotch tweeds, but

if the purchaser deals direct with the Crofters' Agency, or with a branch of one or other of the well-known home industries associations in England and Scotland, he need have no fear of having an inferior article palmed off upon him.

By far the greater proportion of the real hand-made cloth comes from the North of Scotland, where the crofters doggedly preserved their trade long after hand-loom weaving in England had been killed by steam-driven machinery. The survivals of the hand-loom in England to-day have nothing whatever to do with the earlier trade. What one sees in a few country places nowadays is really a revival—an outcome of a desire to reinstate the practice of artistic crafts; in Scotland it was a grim determination on the part of a poverty-ridden people not to be robbed of their scanty means of livelihood that kept the crofter industry alive. The manner in which they held on to the industry can be gathered from the fact that there is now said to be some 6,000 people in the islands about the North of Scotland engaged wholly or in part in the production of home-spuns, there being no fewer than 1,500 spinners and 200 weavers in the island of Harris alone.

Home-spuns, which rely for their superiority over machine-made goods partly on the quality

of the wool used and partly on the amount of twist the spinner puts into the yarn, are necessarily costly, because it will take an average family from twelve to fourteen weeks to spin and weave one web of forty yards. The remuneration is, indeed, very scanty when everything is considered, for the labour put into some of the best cloths is quite prodigious. Many, it is said, do not make out of the industry more than the present-day allowance to an old-age pensioner.

The crofters (or cottars, as they are often called) most famous for the making of these home-spuns chiefly inhabit the islands known as the Outer Hebrides, lying off the western coast of Scotland, and in both language and customs differ in many ways from their compatriots on the mainland. They are a thrifty and simple people, who, owing to the fact that the islands are composed of marshy and rocky soil practically unfit for cultivation, have to depend entirely on the tweed industry and the fishing for their simple necessities. For generations they have enjoyed a world-wide reputation for their skill and craftsmanship in making hand-made tweeds, and although many have tried to imitate them, their efforts have not been very successful. For all their skill, however, these quaint, old-world people are in the majority of cases still very poor, and but for this home

employment would often be in dire straits. When the fishing fails and the harvest is unfruitful, they turn with more than ordinary assiduity to their closely-preserved textile industry, and it is then that the hum of the spinning-wheel and the whirl of the shuttle is heard with unceasing persistency in their lonely island cottages.

The first essential in the making of these beautiful tweeds is that the wool shall be home-grown and of beautiful texture. After it has been thoroughly cleansed, the crofters dye it in a rather crude but serviceable dye-pot. Vegetable dyes are principally used, the necessary herbs being secured from the surrounding hillsides and from rock vegetation. Hand-dyeing is, of course, one of the principal processes in the manufacture, and the mixing of the various colours requires both skill and experience. The recipes for these colours and the blending are jealously-guarded secrets which are handed down from one generation to another. After the wool is thoroughly dyed and dried, it is spun, warped, woven, milled, and cleaned entirely by hand. Both the spinning-wheels and the hand-looms used are of antique design, but even if modern improvements were introduced, it is doubtful if the present results could in any way be improved upon. The work in connection with this industry is carried out

principally by the women and children, but when the fishing season is a failure, as it often is, the men also employ their time by weaving.

One of the characteristics of genuine Harris and other home-spun materials is the pleasant and homely smell which is thrown off from the cloth, and which is accounted for by the fact that instead of coal the crofters burn peat which is secured from the neighbouring marshes, with the result that the peat fumes permeate the material during the process of manufacture. The tweeds are most popular with all classes of sportsmen, and for golfing, walking, cycling, motoring, mountaineering, and other outdoor sports they are unrivalled. Owing to the fact that they are entirely hand-made, they contain peculiar properties which make them cool to wear in summer and warm in winter, and as healthy wearing apparel they have been highly recommended by eminent medical authorities. The natural grease of the wool is retained in the finished material, and this conduces to make the tweed both waterproof and damp-resisting. An old-standing complaint against home-spuns was that imperfections were numerous, but the present-day crofter has now overcome this difficulty, and the pieces which are turned out are practically free of defects.

But real, first-class woollen clothing, such as

these home-spuns are, is a distinct luxury, and there are millions of people who cannot afford to pay its price. This being the case, a great industry has grown up devoted entirely to supplying a cloth which will accommodate itself to the more slender purses, and made up—or "tailored" as it is generally spoken of in the trade—it is generally to be found hanging with lavish display in the windows of our big ready-made clothing establishments. The class of cloth to which we refer has been designated by those in the trade as "shoddy," although it must not by any means be supposed that the word implies an article altogether worthless and to be despised. Shoddy, like better-class cloths, has an almost infinitude of grades: some of it is of that wastrel kind which will "bag" at the knees after the first day's wear, or shrivel up to nothing after the first shower of rain; but the best class of it is only one or two removes from the real thing, and commands a ready sale among those who cannot afford the best, but must have something which will "look and wear well." This big cloth-manufacturing industry has grown up chiefly in and around the towns of Dewsbury, Batley, Heckmondwike, Ossett, and Morley in Yorkshire, and some idea of its magnitude can be gathered from the fact that it employs between four and five thousand persons, and involves an average

consumption of rag wool of 200,000,000 lbs, per annum.

This rag wool and shoddy industry stands altogether apart from what is known as the "Bradford trade," and has its own special trade centres and trade regulations. It has, for instance, in Dewsbury its own properly organised Rag Exchange, which is as important in its way as the Exchange in Coleman Street, London, is to the workers in new wool in the best worsted and woollen towns. To this Rag Exchange flock all the makers of the lower-class goods, and the competition which takes place is extraordinarily keen. The rags and waste, which are graded with surprising exactitude, will fetch anything from a halfpenny to a shilling a pound, the latter figure being not far behind that of some of the raw wool sold on the London Wool Exchange. So great is the demand for these rags that foreign countries, as well as the British Isles, are scoured for all kinds of cast-off clothing and oddments. Russian stockings, it may be noted, are particularly sought after, realising as they do something like 52*s*. per cwt. The amount of rags imported greatly varies from year to year, but will average, perhaps, something like 50,000 or 60,000 tons per annum. In 1891, however, as much as 370,000 tons was brought into England from places abroad.

When dusted, sorted, ground up, and oiled ready for the manufacturer, the rags are divided up into various grades, and known as mungo, shoddy, extract, flocks, and wastes of various kinds. With some of these classes of goods is mixed new raw wool in varying quantities, this, of course, having a great deal to do with quality and price. The range of articles produced from rags, as pointed out, may include anything between the cheapest thing on the market and the best woollen goods, but the manufactures of the "Heavy Woollen District" to which we have alluded also includes good Army and Navy and police cloths, pilots, Devons, beavers, feltings, baizes, druggets, and rugs.

It is estimated, says the "Wool Year Book," that woollen cloth loses, in the apparently endless cycle of transmutation of wear and re-manufacture, about 40 per cent. of its weight, so that the average fibre only completes about three cycles of re-manufacture. The same authority thus concisely gives an outline of what is done in the way of preparation for manufacture in the cases of mungo and shoddy. The processes consist of dusting, sorting, seaming, oiling, and grinding. Dusting is largely a hygienic process. Sorting is in accordance with either quality or colour, or both. Seaming refers to the taking out of every

little bit of cotton thread, which otherwise would cause a bad spin or a "flecked" piece. Without injuring the wool, the cotton is burned out of a mixture cloth by means of a sulphuric acid or other chemical process. Oiling is to ensure a gliding of the fibres on one another rather than rupture, which would mean a poor quality of spinning material. Grinding refers to the teasing-out—the violently dragging apart—of the fibres, so that as much of the original length of the raw material as possible shall be retained.

Among the mill-hands themselves in the Dewsbury and Batley district the description "mungo" is used more often than any other as the generic name for the stuff produced from rags, and the name might puzzle many people who did not know the story of its origin. It is told that in the early days of the trade, a keen, hard-fisted Yorkshire factory master in the rag region had set his spinner the very difficult task of trying to spin something which was little better than food for the furnace. The spinner, after several efforts, went to his master and told him it was impossible to get the stuff to hold together sufficiently to make it into threads. But the blunt old Yorkshireman would not hear of failure, and sent the spinner back to his work with the injunction, "It mun go; it mun go!" ringing in his ears. Ever afterwards,

it is said, the term "mungo" was used by the trade for this particular kind of stuff.

To those who might be a little squeamish about wearing this cheap production, on hygienic grounds, it is only fair to say that the cleansing and purifying processes through which woollen rags must go before being fit for re-manufacture can hardly fail to stamp out any possibility of infection when made up into clothes. At all events, the towns where the rags are collected and handled seem to be quite free from such injurious effects to health, and if there is little possibility of disease in the first instance, there would seem to be very little indeed after the stuff has gone through a number of disinfecting processes, one of which is the chemical bath already alluded to. The death-rate in the towns where the rag trade flourishes seems to be no higher than in other industrial centres, and the Medical Officer of Health of Batley cannot find anything to complain about. He says: "It might readily be assumed that persons employed in the rag trade would frequently contract infectious diseases, owing to the danger of handling rags which come into the town from all parts of the world. Such, however, is not the case. I have found no reason to suspect that any outbreaks of infectious disease have been caused through handling rags during the period I have

been Medical Officer of Health, and I believe such has been the experience of my predecessors. No particular occupation in Batley appears to have a deleterious influence upon the public health."

In addition to employing a large number of people in the making of the cloth, the rag trade has brought into being a whole army of clothiers, and found employment for thousands of tailors and their assistants. The trade was formerly, no doubt, looked down upon, and in all probability the stereotyped cutting and throwing together of suits in factories encouraged contempt. But nowadays a new idea of cutting has arisen, and both the cloth and the wearer are beginning to earn a respect hitherto unknown. In the great factories of Leeds and other places in the United Kingdom, where close upon 300,000 people are employed in the ready-made clothing trade, the wholesale cutting of suits by machinery is being rapidly replaced by the making of "specials," or garments cut to the order and measurements of the individual buyer. This new trade, which has brought into being again the expert cutter, is likely to have a great vogue in the future, and is also, of course, calculated to revolutionise the dress of the working classes. Indeed, a class much above the lower working class is coming to look on this method of production with favour, for the Leeds

scale system of sizes, which is doing for the clothing trade what the American system of minute and accurate measurements did for the boot trade some years ago, is, combined with up-to-date cutting, making it possible for anyone to get a stylish suit perfectly fitted. Thousands of suits ordered from local tailors in the provinces are now cut and finished at one of the great factories which make a specialty of the bespoke business, and "ready for service" clothes of the highest class and made on the same principle can now be purchased at some of the largest and most fashionable stores in London. While the clothes are stock-sized, there is nothing of the "slop-shop" about them, and those people who have no time for making appointments with tailors, and who find the business of fitting and "trying-on" a nuisance, are beginning more and more to copy a practice which is greatly in favour across the Atlantic, and does not by any means preclude the possibility of dressing well.

There is no doubt that on the whole the discovery of the means of pulling rags and re-making the fibre into clothes has had a great and beneficial influence. For one thing, it has enormously augmented the world's supply of raw wool, and that in itself is a great boon when it is considered that the natural wool clip does not exceed 2¾ lbs. per head. It has to be remembered, again, that

this "low-woollen" trade has been the means of keeping the price of clothing within reasonable bounds, and that during the hundred years the trade has been established millions of people, protected from the elements by an article so cheap and serviceable, have had cause to bless the enterprise and skill of those who made it a business to recover and transform this despised waste product of a former day.

It should not be assumed from what has been already written that cloth for men's suits is the sole production of the "shoddy" districts. There are millions of yards of what the French euphemistically call "renascence cloth" woven in and about Morley for the ladies' dress trade, and the material finds a ready market everywhere. Much of the cheap stuff to be picked up on the bargain counters during the drapery sales, and suspected of being of German origin, is in reality made in Yorkshire, and is generally composed of re-manufactured woollen rags mixed with cotton. A full dress piece of 5½ yards of this kind of material can be bought for 2*s.* 6*d.* or 2*s.* 9*d.*, and the quality and appearance are such as Germany cannot possibly equal at the price. It seems impossible on the face of it, but both the manufacturer and dealer will contrive to get a very substantial profit out of the goods. It is a case of enormous

production and a quick turn-over, just as the cheap tailor is able to sell a suit for half a guinea and still make a profit. In the rag wool district he is able to buy as much cloth as will make a suit of clothes for 3*s.* 6*d.*, and this he can have made up for 2*s.* in the big clothing factories.

From the foregoing it can be readily assumed that there are nowadays practically no by-products in connection with wool itself—although there are a few created in the course of manufacture—for high prices of the raw material have made it worth while to deal drastically with all woollen waste. At one time old-fashioned people did not imagine that a bed could be a bed unless it had a good foundation of woollen flocks, but nowadays a much cheaper substitute is commonly used.

With regard to beds of flocks, it is interesting to recall a curious incident in connection with the great "cotton panic" which resulted in a famine in the raw material in the North of England owing to the American Civil War. So badly was cotton needed that certain ingenious persons conceived the notion of going round to the houses of the poorer folk and offering them attractive prices for their beds of cotton flocks. Many respectable fortunes were made in this way, and the vendors were well satisfied with their bargains

seeing that the extra prices gave them the opportunity of indulging themselves, for the first time in their lives, in the luxury of woollen flocks, which they promptly substituted for the vegetable fibre upon which they had previously slept.

CHAPTER XII

THE VARIED USES OF WOOLLEN

It will have been noticed how tenaciously special classes of goods produced in the wool industry cling to certain localities, and no doubt, if we could trace them, there are ample reasons why these trades should have begun and flourished where they did. Often the reasons were personal, and had nothing whatever to do with suitability of climate or geographical conditions, and in these instances it will sometimes be seen that industries have waned when a less gifted and energetic generation have grown up, while nothing, perhaps, now remains but a name to mark an early greatness. It says much for the men engaged in the various sections of the trade that the old designations remain in the great majority of cases. Bradford is still the great world centre for worsteds; Huddersfield remains the home of high-class cloths; Leeds is unassailable in the wholesale clothing trade; and Halifax and Dundee are famous for the production of carpets. Rochdale holds its former advantage in Army and Navy

flannels; Witney still maintains a fair trade in blankets; the West of England was long known for broad-cloths; and various parts of Scotland and Ireland hold an unquestioned sway in homespuns and tweeds of various sorts; and often parts of the country are familiarly known for specialities which have in many cases borne their names for centuries.

Many of the places mentioned have been spoken of already in this book, but there are certain others which are deserving of note for the high places they hold in the world of woollens. One has, for instance, only to recall the names of Leicester and Nottingham to be made aware of the large accession of wealth and fame which has been brought to those towns by the modern manufacture of hosiery. Leicester is to-day the great seat of the English hosiery trade. It employs close upon 30,000 persons in that trade, if the yarn spinners are included, and individual mills are known where 3,000 people are engaged in the work. Its progress is no doubt due in part to its advantageous situation as a railway centre, and also to the readiness with which its inhabitants have taken up the various inventions for knitting, and also improved on the work of outsiders by discovering the secret of "seamless hose" and other productions which have made the town

famous. Nottingham, however, is really the birthplace of hosiery. It was to Nottingham that Hargreaves and Arkwright went with their inventions, the spinning jenny and the water frame, and it was a Nottinghamshire man who conferred a boon on humanity by inventing the stocking frame.

The hosiery trade, which was born amid difficulty and disappointment and developed in the face of much violence on the part of the displaced hand-knitters, is now most prosperous, and one of the best paid in the country. The chief hosiery centre in Scotland is at Hawick, but there is also a large amount produced in Glasgow, while Dumfries has specialised in the knitted-glove trade. There is also a good trade done in Irish hosiery, which is hand-knitted by the peasants of Donegal. The Scotch tweed industry is another flourishing trade which swallows up a large amount of wool, Galashiels, Selkirk, and Peebles taking a big proportion of the 30,000,000 lbs. which is annually required for the manufacture of that excellent cloth from which smart suitings are made. The Cheviot sheep of the Lowlands, numerous as they are, do not produce more than about one-sixth of the wool required by the manufacturers, who make up the deficiency by purchasing largely of the cross-bred wools of New

Zealand and the product of the Cheviot flocks which have survived early settlement in the Falkland Islands. It is stated that about 12,000 people are engaged in this branch of the industry, and that the superior cloth they produce will, when made up into suits, represent a value of about £12,000,000.

Ireland, also, does a fairly large and increasing trade in woollens and tweeds, although it must be said that the industry, speaking generally, has been much hampered in the past for want of capital. There are a few large and up-to-date mills, but the majority are small factories employing less than a hundred hands each, and are chiefly engaged in the manufacture of flannel, blankets, heavy serges, shawls, and travelling-rugs. There is also a considerable peasant industry, chiefly in the north and west, these goods, chiefly hand-spun and hand-woven, having of late years been in much demand.

The West of England trade, so famous in an earlier day, is now completely overshadowed by that of Bradford, although from that side of the country still comes some of the finest and most durable cloth made in the world. The broadcloth, so prized by our grandfathers, was long ago beaten out of the field by Yorkshire worsteds, and the trade of Gloucestershire and Wiltshire was

whittled down to very small proportions. In Somersetshire, however, where worsted has always been in use for the making of serges, the manufacturers quickly adapted themselves to the change in fashion, with the result that in places like Wellington the trade has been able to survive on a more respectable scale. The excellence of the work done in Somerset still attracts many of the best English Government and Colonial contracts, while in Gloucestershire are yet made those fine scarlet cloths worn by hunting men, as well as cloths for naval and military uniforms and liveries. It is interesting to recall, also, that it was at Wellington that the first woollen khaki was made, and that at the present time a speciality is made of knitting cloth for puttees. The old town of Wilton in the West Country still makes the famous carpet of that name, and of recent years local trade has been stimulated by the introduction by Nottingham firms of the machine-made lace industry.

A little outside the industrial circle of the West Country is to be found the small Oxfordshire town of Witney, which to this day makes the blankets for which it was famous in the seventeenth century, if not before. The blanket, of course, was made much earlier than that period, it being authoritatively stated that the article

got its name from Thomas Blanket, a Bristol weaver, who produced "a fabric of wool with a well-raised nap" in 1320. Witney was identified with the wool trade more than a century before that date, for it is on record that Henry III., while on a visit to a certain Bishop of Winchester, who had a palace there, "spent twenty pounds upon his wardrobe," although we are not told precisely upon what articles the money was laid out. It is understood, however, that the royal purchases were of articles produced by the woollen manufacturers then settled in the place. Nowadays, of course, Witney does not make a tithe of the blankets put upon the market, but the town, despite the pretensions of its big rivals in Yorkshire and elsewhere, can still command the highest prices for what it produces. The Witney manufacturers have more than once gone into court to prevent the name being used by outsiders, and on one occasion they gained a very notable victory over Yorkshire traders who contended that the name was a generic one, and could not be wholly appropriated by the town which bears that name.

Mention should be made here of the woollen goods manufactured for the Army and Navy, because many great mills in different parts of the country are kept running all the year round on these contracts. Woollen cloths, it should be

remembered, form the bulk of both Army and Navy fabrics, and the authorities are exceedingly strict as regards both the appearance and quality of the goods manufactured for our soldiers and sailors. Great quantities of these cloths are manufactured in and about Leeds, Dewsbury, and Batley, but the best class of uniforms are made in the West of England, which has always had pre-eminence in this country for dyeing and finishing the highest class Army cloths. Rochdale has long made a speciality of the flannel from which soldiers' shirts and sailors' clothes are made, and no other town has yet equalled the quality and finish of the famous "silver-greys" and "navy-blues" it produces. The history of many of the firms engaged in the manufacture of flannel in the town goes back three or four hundred years, and it is doubtful whether, from the time Army contracting first began, local mills have ever been without Government contracts. Rochdale is one of the oldest woollen centres in the country, and, unlike so many other Lancashire towns, has shown no desire to have its ancient trade swallowed up by the newer industry of cotton. At one time its main streets were the rendezvous of the best-known wool dealers in the North of England, and it still retains on its civic coat of arms and in the names of some of its older hostel-

ries a reminder of the days when it held a specially proud position in the woollen trade of the country.

Lancashire at one time had many towns devoted more or less to woollen, and as late as the end of the eighteenth century woollen manufacture was put down as the chief industry in the county. But the County Palatine seemed to take a keener interest in cotton from that time onward, as is clearly shown by the way in which the natives put their inventive genius at the service of the younger industry, and there seemed to grow up almost a tacit agreement between the two neighbouring counties of Lancashire and Yorkshire that cotton should flourish on one side of the Pennines and woollen on the other. Whether Lancashire deliberately pushed out woollen in favour of cotton, or Yorkshire by dogged tenacity and perseverance gradually succeeded in attracting the bulk of the trade in wool to itself, is not a very profitable speculation at this time of day, but the circumstances in which both trades were built up have many curious and inexplicable features. Suffice it to say, that the two counties were able to rear huge textile businesses side by side, and while the trades substantially differed in kind, they became, as time went on, remarkably friendly and inter-dependent. This was strikingly shown a few years ago when a big cotton

strike in Lancashire had very disastrous effects on a great portion of the Yorkshire trade—that section which relies more and more upon cotton for "unions" and other mixture cloths.

Whatever may be said of the West Riding generally, there is no doubt that Bradford itself, the pivot upon which the world's trade in wool, manufactured and unmanufactured, turns to-day, owes its great and influential position to the enterprise and genius of a succession of brilliant inventors and industrial organisers. So far as can be seen, the city had no special natural advantage over any other town in Yorkshire—neither in coal, water-power, humidity of atmosphere, nor in any other essential can it claim superiority over its neighbours—and therefore we must look elsewhere for the secret of its dominating position as a marketing and manufacturing centre.

The town undoubtedly dates its rise from the time the machine supplanted manual labour for the purpose of combing wool. Before the middle of the first half of the nineteenth century the wool trade in Yorkshire may be said to have been in a rather backward state. True, a great many people were employed in it, but the progress of the trade was hampered owing to the fact that invention had not kept pace in every department. The preparatory stages lagged behind the spin-

ning and weaving—at least this was so in so far as worsted was concerned. Hand-carding had been superseded by machine-carding in the woollen mills, and spinning had made a great forward move, but for long years after the spinning-frame had been invented the slow and laborious process of wool-combing by hand was in vogue. Indeed, it was not until about 1830 that means were found to comb wool by machinery, and the innovation was even then stoutly resented, the introduction of power machinery being attended by some of the most serious industrial riots the country has known.

The invention, however, proved the turning point in the fortunes of Bradford. Instead of remaining an agglomeration of villages, it rapidly took upon itself the features of an important town, and other places in the West Riding also began to wax apace. The old domestic system, interesting as it was, and representing the industry on its more human side, speedily vanished, and in its place rose a great factory system which brought fortunes for the manufacturers and a prosperity to the workers hitherto unknown. With the introduction of the jacquard and other inventions the finest of cloths began to be produced, and, a lucky chance bringing royal patronage for a special Huddersfield worsted pattern,

the trade went up by leaps and bounds, to the great detriment of the West Country smooth broad-cloth trade.

Side by side with the genuine worsted trade the woollen shoddy industry of Dewsbury and Batley was developing, and in 1839 still further success was registered by the opening up by two famous Bradford firms—Sir Titus Salt, of Saltaire, and John Foster, of Queensbury—of the trade in alpaca and mohair goods. The progress of Bradford can easily be judged from the fact that at the beginning of the nineteenth century it was a place of only about 5,000 inhabitants; in 1830 the number had jumped to over 43,000; while in 1850 the population numbered over 100,000. From only one mill in 1800 the number of factories rose to 129 in 1850, and the hands employed had risen to over 33,000. At this same date—1850—there were in England 493 worsted factories with 864,874 spindles and 32,617 power-looms, while the number of operatives was 78,915, or about double the number there were ten years earlier. It is safe to say that the majority of factories, spindles, and looms mentioned in the return were in the West Riding of Yorkshire, and were engaged in what came to be known the world over as the "Bradford trade."

Since that date the progress of Bradford has

been steady but continuous, until now it boasts a population of over 290,000, and has attained to the proud dignity of a city. At the present day Bradford, besides doing the bulk of the home trade in wool, dominates the London sales of imported wool. It is estimated that four-fifths of all the wool imported into England goes to Bradford to be combed into tops or spun into yarn. Nowadays, the city does not manufacture a great deal of the wool it handles; it exports very extensively both in the tops and in the spun yarn. The home trade takes a fair amount, but large quantities have hitherto gone to the Continent of Europe, Germany and France being two of the largest buyers.

These tops are very popular with the manufacturers, as there is no washing of the wool to be done, and the fibre is in a sufficiently advanced state to allow of it being handled straight away. When ready for the spinner, the tops contain 3 per cent. of oil and 16¼ per cent. of moisture. At least, that is the amount of water that they ought to contain, and if it is exceeded the municipal testing office, or Conditioning House as it is called, will issue a certificate which is binding on both seller and buyer, so that the former must credit the latter with an amount of money equivalent to the excess of water that is present in the top.

In addition to cloth yarns, Bradford has many mills running exclusively on yarns for the hosiery trade. Moreover, along with a huge and highly specialised wool-combing business—this trade being now very largely done on a commission basis—Bradford is the headquarters of a dyers' combine which is the most important association of its kind in existence.

Alongside the development of the wool industry there have grown up many kindred institutions of which Bradford to-day is justly proud. These include the famous Bradford Technical College, which boasts a complete plant for the washing, carding, combing, spinning, weaving, dyeing, and finishing of textiles, and is staffed by the ablest experts in the country; an Exchange which is famous both for its transactions and its *personnel* (many members being able to trace back their commercial genealogy to the primitive beginnings of the trade); and a Conditioning House, which, though only established in 1891, bids fair soon to have more extensive dealings than any other in the world. Even now it may be said to stand first in reputation, for its trade regulations are most stringently carried out, so much so, in fact, that its certificates are adopted without question not only by those in the trade in every part of the world, but also in the law courts.

Next to the woollen and worsted trades comes the trade in hosiery, which is growing by leaps and bounds each year. The gross output of the industry, which is largely concerned with wool, is now returned at approximately £10,000,000. Originally the name was used to denote foot-wear exclusively, but now the term is applied to every variety of knitted goods. Up to the end of the sixteenth century, stockings, which were practically the only form of hosiery then known, were either hand-knitted or cut out of woven material. The latter method precluded all possibility of obtaining that quality of elasticity which is the main advantage in knitted goods.

The world in indebted to a clergyman for the comfort of hosiery, the inventor of the stocking-frame being the Rev. William Lee, curate of Claverton, in Nottinghamshire. By means of this invention, which was made workable in 1589, a row of stitches could be made at once instead of one at a time. Queen Elizabeth accepted a pair of silk stockings from Lee, but did nothing for the inventor, who, in consequence, accepted the patronage of Henry of Navarre, and died in France after the assassination of that king. After his death his brother, James Lee, established the manufacture of hosiery in London, and in 1660 Charles II. gave a monopoly to the London com-

pany. It is stated that, in the year 1695, 1,500 stocking-frames had been set up in the Metropolis, but the industry was gradually removed to the Midland counties. In the year 1714 there were 8,000 stocking-frames at Nottingham. These had increased to 11,400 in 1753, when the London company's monopoly was ended by Parliament, and to over 20,000 by the end of the century. The task of comparison is not, however, a simple one, owing to the increase in capacity of the frames, but the available statistics show that by the year 1844 there were over 48,000 stocking-frames at Nottingham.

The original machine produced merely a straight piece of plain-knitted fabric, but by the method of transferring stitches to other needles a means was discovered of "fashioning" the material produced—that is, of so altering the width as to shape the leg, heel, and foot of the stocking.

The inventions of ribbed and seamless hose came later. The machine on which ribbed hose was first made was the invention of a Derbyshire farmer named Jedediah Strutt, an ancestor of the present Lord Belper. This notable improvement consisted in adding to Lee's machine a second series of needles with an arrangement for working them, the original machine being capable of making only a plain web. Seamless hosiery was

another great advance, but this time the credit went to France. Brunel invented in 1816 a circular knitting frame capable of producing a tubular web, and this was later on improved upon by Claussen, of Brussels. Following upon this came the loop-wheel circular frame, introduced by Moses Mellor, of Nottingham, in 1850, and Townsend's latch wheel and the warp machine marked further distinct advances in the progress of the industry, and led to the introduction of both rib work and fancy stitches. After producing a seamless "fashioned" stocking, the hosiery manufacturers of Leicester turned their attention to glove knitting, and have made of this department a technical and commercial success.

Leicester has made enormous strides in the development of the hosiery trade in recent years, and there are at least thirty firms engaged in hosiery manufacture in Nottingham, one of which is the largest undertaking of the kind in the world. The industry finds employment for many thousands of workpeople, and the annual value of the output reaches several millions sterling. With regard to the supply of raw material, very little spinning is done in Nottingham itself, the yarn being obtained either from the Yorkshire district, where some of the spinning mills are engaged entirely upon the spinning of woollen yarns for

hosiery manufacture, or from France, Germany, and Belgium. There is also much cotton and silk used in the hosiery trade. The cotton yarns are obtained from Lancashire, though there are several doubling mills in Nottingham, and the silk yarns from various English houses. Hosiery is also extensively manufactured in France, Germany, and other Continental countries, and hosiery factories are in active operation in New York and neighbouring States.

This class of knitted goods, owing to its looped formation, gives an elasticity which is not possible in woven work, and is suitable for a thousand different kinds of articles of wearing apparel. Those that most readily come to mind are stockings, gloves, shawls, jerseys, mufflers, cardigan jackets, caps, and underclothing of every kind. Wool is used for the best class of goods, but cotton is blended very extensively in the cheaper qualities, while the highest class of fine goods often contain a large amount of silk.

In the hosiery centres of England and Scotland —Hawick, Dumfries, Lanark, and Glasgow chiefly representing the hosiery trade across the Border —the conditions of employment are excellent. Female labour is largely employed, and both men and women are among the best paid workers in the country.

Another section in which huge quantities of wool are consumed is the carpet industry. Strictly speaking, the making of carpets is a separate and distinct trade, but nevertheless it is an industry requiring a preponderance of wool, although the wool is of a different class from that from which "woollens" and "worsteds" are made. Carpet wools are not so good as those used for making dress-stuffs or flannels, nor are they so coarse as the common felting wools. The animal which chiefly supplies this wool is to be found in Asia Minor and places further east, where the carpet industry first began, but since the trade was taken up in Great Britain and machines superseded hand production, other kinds of wool have been pressed into service, notably that from sheep reared in Australia and New Zealand, and fleeces from the hardier breeds in our own country. Carpets are not often made from wool throughout; they are mostly wool-faced with backings of flax, jute, or hemp, the binding thread being strong cotton. It is calculated that the number of persons employed in producing machine-made carpets in the British Isles is close upon 20,000, and that the work is carried on by about seventy firms, chiefly located in the Midlands, the North of England, and Scotland.

The place-names in vogue for the various kinds

of carpets are nowadays altogether misleading. One of the best-known makes of carpets is, of course, Axminster, but it is generations since carpets were made in the Devonshire town of that name. Axminster carpets, indeed, seem to be made at almost any other place than Axminster, just as Kidderminster, although still a well-known manufacturing centre, turns out few carpets of that name. Kidderminster carpets are now made chiefly in Scotland, while Kidderminster confines itself almost exclusively to Brussels, Wilton, Axminster, and other makes. Similarly, we do not get carpets from Brussels, that class of carpet nowadays being very largely manufactured in Halifax, Rochdale, and other British northern towns. Brussels carpets are also extensively turned out at Dundee, the great centre of the jute carpet trade. Wilton is one of the few existing places which actually makes the carpets associated with its name, but it by no means makes all the Wilton carpets put upon the market. About a third of the carpets made in England are exported, Canada, which buys so largely of English woollens, being the best customer, and other parts of the British Empire taking a very large proportion of the remainder. Of the eight million yards exported annually, Canada takes well over two million.

WOOL SORTING AND CLASSING IN NEW SOUTH WALES

Formerly, a large quantity of wool was used in the manufacture of felt hats, but in these days the best class of "bowler" is made from the fur of the rabbit, and only the cheapest felts are manufactured from woollen waste. This trade is mostly carried on on the borders of Lancashire and Cheshire, the chief centres being Denton and Stockport. Many of the best-known firms can trace their histories back to the eighteenth century, having first made the beaver hat, at one time so fashionable in this country.

In a chapter dealing with the many varieties of wool it is impossible to overlook certain fibres which are sometimes regarded as hair, but have really more of the characteristics of wool than of hair, and which in manufactured form are regarded as among the most valuable and beautiful products of the Bradford trade. Such are the hair group of materials, chief among which are alpaca and mohair. The alpaca, or llama, as it is sometimes called, is a native of the Andes, where it thrives on pastures about 5,000 feet above sea-level. The long wool of the alpaca is soft, pliable, and elastic. It ranges in colour anywhere between white and black, and is manufactured into very attractive dress and lining fabrics. Alpaca is usually dyed black, but mohair, which is obtained from the Angora goat, a native of

Turkey and Asia Minor, has the qualities of the alpaca with an added lustre, and can be dyed to any shade. It is used for making dress materials for ladies' wear, and also for linings, plushes, braids, and furnishing fabrics. A large quantity of mohair yarn is sent to the Continent of Europe to be woven there owing to the high tariffs on the manufactured article, but to such a pitch of excellence has the spinning of mohair yarns been brought in this country that practically all the yarns used by the foreigner are made in England. The trade, with which the name of Sir Titus Salt, of Saltaire, Bradford, is so closely associated, has long been a flourishing one, and appears likely to remain so now that the mohair goat has been acclimatised in South Africa, and large numbers are being reared at the Cape.

CHAPTER XIII

THE FUTURE OF WOOL

THE new century has brought about changes in the traffic and production of wool which are having very far-reaching effects. Not only has the home consumer, for economic reasons, begun to buy a large quantity of his wool in Sydney, Melbourne, and Adelaide instead of in London, and not only have new countries entered into the field as manufacturers, but certain industrial developments have diverted a large portion of the wool trade into widely different channels. The total weight of wool used in these islands is perhaps not much less than formerly. For some time past we have imported annually about 600,000,000 lbs. of wool from Australia, New Zealand, the Cape, the Argentine, and a few other places, and in addition have consumed the greater part of the product of the 30,000,000 home-reared sheep. In certain cases, however, its manufacture is taking a different shape and causing what amounts to an upheaval in some of our old-established trades. There are, however, signs

that the English manufacturer is ready and willing to adapt himself to a new order of things, and therein may lie his salvation.

A writer on the subject in *The Times* takes quite an optimistic view of the future. Upon the whole, he says, there never was a time when the prospects in the woollen and worsted industry were as bright for those who have taken or will take the trouble to equip themselves and are prepared to use up-to-date methods in every phase of their work. Speculation is undoubtedly still too much in evidence in the wool trade, but the days are passing, if they have not already passed, when gambling in wool can seriously impede the industry, for it is obvious that well-directed and organised control is day by day becoming more and more dominant. Again, the day is rapidly passing when businesses may be conducted solely for dividend purposes. There is wisdom in recognising this, and in realising that no firm can hope to score a lasting success which does not base its organisation upon a large-minded, comprehensive policy, upon the introduction of scientific method into all its activities, and upon a candid recognition that it has fairly and squarely to play its part in the industrial economy.

Before the outbreak of the great European War, which caused such a boom in every branch

of the wool trade, the worsted section was in a fair state, but the outlook in the woollen industry was not by any means rosy. The worsted section was doing none too well owing to the inroads which were being made into the trade by the plausible shoddy stuffs of Dewsbury and Batley, to certain changes in fashion, to the introduction of flannelette and other cotton substitutes, and to some extent to foreign competition. There was, indeed, a great falling off in the demand for the genuine woollen as distinct from the worsted article. The result was that many woollen mills were closing their doors, and the stranded work-people were beginning to swear allegiance to the all-conquering King Cotton. The naval and military authorities, it is true, had not broken with the old and highly-reputable firms who serve the sailors with their serviceable navy blue and the soldiers with their unsurpassable silver-grey flannel, and there still remained, too, a large foreign and colonial market; but it was none the less a fact, that many old wool men had begun to shake their heads and predict the direst of things for the trade to which they had been so long attached, and which had behind it so many ancient and honourable traditions.

The chief reason for this foreboding was that the woollen trade had been the victim of a radical

change in fashion; indeed, the change marked an epoch and not a mere whim or passing fancy. The appearance of the Athletic Girl towards the latter end of the nineteenth century brought about an alteration of the whole scheme of things sartorial, so far as ladies were concerned. When English maidens began to play hockey and golf, to develop their muscles in gymnasia, to shoot and fish and row, they found that the style of dress approved by their home-staying grandmothers was totally unsuitable. It was too bulky and too full of restraints. So the Leicester and Nottingham hosiers, seeing a rare opportunity held out to them, began to produce close-fitting knitted hosiery, which, while being warm and serviceable, allowed our Dianas to shed their great burdens of underclothes. The flannel petticoat was the first to go, and with it, of course, went the dowdiness inseparable to thick, heavy clothing. Penelope, seeing at a glance that her athletic sister's form had been distinctly accentuated and improved in the process, quickly adopted the new fashion in her own behalf, with the result that flannel lost to an enormous extent its former popularity. Worsteds may have been hard hit by such a mode as that of the hobble-skirt, but that, of course, was only one of Fashion's passing vagaries, not an absolute revolution in dress, as was the case

with the wearers of thick flannel petticoats fifteen or twenty years ago.

But while knitted goods, it may be remarked, may have some advantages over flannel from the point of view indicated, they have obvious disadvantages if not of the best kind. Cheap cotton-mixed hosiery carries with it many penalties in such a climate as ours; but, despite the warnings of medical men, even the article in which wool is only to be found in a vanishing quantity seems now to be preferred to the less tidy but more healthful garment, and for good or evil knitted goods have undoubtedly come to stay.

As pointed out, this remarkable turn of Fashion's wheel has done more than any other thing to injure the woollen trade, although it must be said that flannelette, also, has superseded purely woollen goods for a variety of domestic purposes. In some households, already, pure wool has become almost as rare a thing as pure silk, all kinds of substitutes having been introduced, principally from supposed notions of economy.

It should be said, however, as an offset to the decrease noticed in the case of woollen goods, that so far as worsted fabrics are concerned, there has been during the past few years a better demand for goods made from the genuine article. The West of England, the former home of the

"broad-cloth of respectability," still stands for quality, and Wiltshire, Gloucester, and Somerset have for some time found fashion distinctly in their favour owing to the styles of cloth being quieter and neater; while the Leicester and Nottingham trades, which employ approximately 40,000 people, have found not only that the warm knitted goods required by the motorist have added appreciably to the bulk of their manufactures, but that special branded makes of all-wool goods are being more and more called for. Those soft, light, yet hard-wearing home-spuns made by the Irish peasantry were also having a special vogue for sporting purposes before the war, as were the Harris and other tweeds for which Scotland is famous. Trade was also reviving in the better-class serges and cheviots, and in all goods made from mohair. Another product of the industry for which there is always a great and regular demand is knitting wool, of which large quantities are turned out at the Scottish town of Alloa.

At home, therefore, while there are several factors at work which indicate that we shall have to look for a reduction rather than an increase in consumption when normal times return again, there are others of a more encouraging character, and, in spite of a probable increase in competition,

Great Britain will no doubt in the future continue more than to hold her own both at home and abroad.

It has always been an interesting speculation as to whether England will be able to maintain pre-eminence in wool manufacture in view of the expansion which is taking place both within the Empire and in foreign countries. Possibly no country in the world is better placed as regards fuel, machinery, and climatic conditions, but nevertheless there are signs and portents that the position of Britain is being challenged from many quarters—from America, from the Continent of Europe, and from her own great and growing colonies. Many nations have undoubtedly begun to manufacture for themselves, but, try as they may, they have still to come to England for the finest products of the spindle and the loom. America, for example, has of late years busied herself in securing British managers and British textile machinery, but, with all her efforts, she cannot yet make the best class of "stuffs" and cloth. Germany, which had gone ahead so rapidly before the war, will probably for a long time be handicapped in the race; and France, which is Britain's most serious rival, is still bound to acknowledge England's supremacy in many departments of manufacture. Indeed, notwithstanding tariff

walls, and the fact that Englishmen are to be found at the head of nine out of every ten foreign firms, the British product is still able to hold its own against the world.

Probably, as time goes on, Britain may find among her keenest rivals one of her own colonies. Australia has begun to ask herself precisely the same question that Queen Philippa, the consort of Edward III., asked hundreds of years ago: Why should the country that grows the wool send it to the other side of the world to be manufactured, when it could perhaps be manufactured at home without that trouble and expense? Possibly the British manufacturer would reply that the shoemaker should stick to his last—that a complete answer is to be found in the fact that Australia is best adapted for wool-growing, while England has every advantage in the matter of manufacturing. But this answer is evidently not deemed sufficient in Australia. In addition to expanding its wool markets, Britain's daughter at the Antipodes is beginning to dream dreams of industrial expansion and striking achievements in the great world of textile manufacture, and is already fostering those dreams by means of Government subsidies and by the equipment of factories on British lines.

As showing how earnestly the people of Australia are beginning to deal with the matter, it

need only be pointed out that an Inter-State Commission has been brought into being for the purpose of considering how best the infant trade of wool manufacturing can be encouraged and protected. Quite recently it sat to consider an application for the alteration of the rate of bounty to $^{7}/_{8}d.$ per lb. on all wool tops exported, and to consider, also, an increase in the limit payable in any one year to £20,000, the removal of the duties on textile machinery and on spare parts for such machinery, as well as an increase of the duties on all woollen and cotton yarns imported to 25 per cent. The application in so far as it related to cotton yarn was subsequently withdrawn, and the suggested rate of duty on woollen yarns was amended to 35 per cent. general and 30 per cent. preferential.

The evidence placed before the Commission was very interesting, and the arguments submitted must have had considerable weight with the Commissioners. It was pointed out that England, France, Germany, and the United States were all great because of their industrial development, and that it was only by industrial development that the future of Australia would be assured. Australia, it was stated, produced wool yearly to the value of £24,000,000, and the manufacture of that wool gave employment in other countries,

directly and indirectly, to about 1,000,000 work-people. The value added to the wool after it left Australia was about £50,000,000, in which Australia did not participate. This being the case, the time had arrived when Australia should not be satisfied with merely supplying cheap raw material to other countries, but should embark on the manufacture of that raw material wherever possible. If Australia were only to convert all her wool clip into tops, £6,000,000 per annum would be added to its value in the country where it was grown. The market for tops, it was pointed out, was world-wide, as was to be judged from the fact that England, after importing wool from Australia and elsewhere, exported about 75,000,000 lbs. of tops yearly, and also imported fine quality tops from the Continent. Tops, it was argued, could be produced in Australia and shipped cheaply enough to undersell English tops in England, or German-made tops in Germany, while Australia was most favourably situated to supply the large and growing demand for tops in Japan and China.

As a further inducement to act, and act quickly, the following letter, written to the Commissioners in December, 1914, by one of the most prominent manufacturers in Australia, shows how heartily the people at the Antipodes are entering into the

question of home production, and what English and other manufacturers may have to face in the future:—

"I desire to call the attention of the Commission to the almost imperative necessity of establishing spinning mills in Australia, because of the conditions that will be brought about by the war.

"Practically the whole of the wool industry of France is centred in the North, mainly in Rheims and Roubaix-Tourcoing districts. A recent cable stated that the mills in Rheims have all been totally destroyed—the damage being estimated at fourteen millions sterling. When the German Army now in occupation retreats, it is more than probable the Roubaix-Tourcoing district will similarly suffer.

"In Russia, the most important centre for woollen manufacture is Lodz, which is the scene of terrific destruction at present.

"After the war, it is probable that England, America, and Japan will be the only countries left with textile machinery, and the building up must be very slow, as Mulhausen, which is the Continental centre of textile machinery manufacture, has also suffered severely.

"It follows that England, America, and Japan will be called upon to provide the world with wool yarn. France, Belgium, Russia, and perhaps Germany also, will have to resuscitate the industry anew. They will probably for a considerable time attempt only weaving and knitting, importing the combed and spun yard, instead of combing and spinning themselves.

"The present difficulties of importing yarn to Aus-

tralia will then be much increased, so that further accentuation is given to my contention that the woollen industry in Australia cannot progress as it should unless supplies of yarn are available locally.

"It seems, therefore, that it would be wise if steps were taken to encourage the industry immediately, so that machinery might be obtained now from England, whilst machinery makers can supply it. It is more than probable that later the English makers will be inundated with orders that may take years to execute."

New Zealand, also, is beginning to be a factor on the industrial side, as will be seen from the circumstance that the quantity of wool purchased by local mills has yearly grown from 2,476,155 lbs. in 1894 to 6,823,545 lbs. in 1913. The latest returns available show that there are eleven woollen mills and fourteen hosiery factories in the dominion, employing 1,410 and 527 persons respectively.

It must, of course, be remembered, when speaking of new countries taking up manufacturing, that, like Rome, big woollen industries cannot be built up in a day, for there are many factors, apart from the possession of raw material and machinery, which go to make up success in textile manufacture. Climate, of course, is a very important one, and craftsmanship is another.

It is not mere chance, as we have shown, which has converted Lancashire and Yorkshire, with

their exceptionally humid atmospheres, into the places where spinning and weaving can be done under ideal conditions, and the most expert of imported managers and overlookers would have to wait long years before they could train unaccustomed labour to be as deft and clever as the factory people of the North of England.

Wool-working, like the making of wine, depends very largely for its success upon the personal element. The product of the new vineyards of the world may be quite as choice as that of France, but made and matured by alien hands it never reaches the same state of perfection in the bottle. It is the same with wool. The Briton must always have been exceedingly apt at the trade, for he was not long before he showed much more skill in the industry than the Roman who taught him, and centuries ago his fame went abroad into the Low Countries as a wool-worker of extraordinary ability. His spinning, they said, was like unto the spider's web for fineness. Endowed with the skill of successive generations, his hand shows that it has by no means lost its cunning. The fineness of his work nowadays can be judged when it is stated that in some places in Yorkshire, where much silk is used along with the wool, silk is sometimes employed of so fine a texture that it requires 20,000 yards of it to make an ounce.

CHAPTER XIV

SOME SALIENT FACTS AND FIGURES

THE total number of sheep in the world at any time can at best be only estimated, but the highest authorities agree to figures ranging between 620,000,000 and 630,000,000. The amount of raw wool the sheep of the world annually produce is in the neighbourhood of 3,000,000,000 lbs.

Wool is a product which is continually varying in quantity—a wet or dry season at home and abroad, for instance, may make a difference in the yield of thousands of pounds—it is often grown in places so remote as to make it impossible to check the numbers of the flocks, and important variations also occur through differences in the estimates of available supplies of greasy and scoured wools. And if there is uncertainty in the matter of raw material, there is again no little difficulty in making reliable computations on the manufacturing side, where a trade boom or depression may make vital differences, and where a passing fashion may profoundly affect public consumption and the demands of the merchants.

Unfortunately, also, official statistics are not kept up to date, the factory returns, for instance, being in the majority of cases many years old.

The war, too, created an abnormal state of things in the wool trade. The demand for wool was altogether phenomenal, and prices were greatly inflated. Business on the London Wool Exchange was remarkable both for quantity and high prices. Eight series of sales had to be held in 1915 instead of six, the number of bales dealt in being over a million, or an increase of 311,000 over the previous year. The explanation is to be found in the enormously greater quantity of clothing used and destroyed by armies in the field as compared with the same number in civilian occupations; the spinning of thicker counts of yarn, enabling a larger weight of material to be turned out by the reduced machinery working; and the storing up of raw material in the United States and the River Plate for shipment to enemy countries at the close of the war.

As regards the size of its flocks and the quantity and quality of wool produced, Australia nowadays occupies the foremost position among the sheep-raising countries in the world. The Argentine Republic comes next, and the United Kingdom and the Cape run a tight race for the sixth place.

As will be seen from the accompanying table,

Table I.—Number of Sheep in Various Countries

Country	Date	No. of Sheep
Australia	1913	85,057,402
Argentine Republic	1911	80,401,486
Russian Empire [1]	1912	74,066,167
United States of America	1912	52,362,000
Ottoman Empire	1908	40,000,000
Union of South Africa	1911	30,656,659
United Kingdom	1912	28,967,495
Uruguay	1908	26,286,296
New Zealand	1913	24,181,810
British India [2]	1910	23,280,662
France	1912	16,467,700
Spain	1912	15,829,954
Italy	1908	11,162,926
Austria-Hungary [3]	1910 1911	10,976,305
Algeria	1911	8,528,610
Bulgaria	1905	8,130,997
Germany	1912	5,803,445
Roumania	1900	5,655,444
Chile	1911	4,168,572
Servia	1910	3,808,815
Mexico	1902	3,424,430
Portugal	1906	3,072,988
Canada [4]	1912	2,084,594
Norway	1907	1,393,488
Sweden	1911	945,709
Netherlands	1910	889,036
Tunis	1911	766,848
Denmark	1909	726,879
Iceland	1910	578,634
Belgium	1895	235,722
Switzerland	1911	161,414

[1] Including goats.
[2] Exclusive of Eastern Bengal.
[3] Austria 1910, Hungary 1911.
[4] Exclusive of British Columbia.

Australia has over 85,000,000 sheep, and the output of wool for the season under notice was valued at over £28,500,000. The bulk of this wool is exported, but with the increased activity of the local woollen mills there has in recent years been an increasing quantity used in Australia, although even now the amount so used represents little more than 1½ per cent. of the whole clip.

About 39 per cent. of the exports of wool from the Commonwealth is despatched to the United Kingdom, the other leading consignees being France, Germany, Belgium, the United States of America, and Japan. The greater part of the wool grown in Australia is now sold in the local markets prior to export. Buyers from all over the world attend the sales held regularly at Sydney, Melbourne, Geelong, Brisbane, Adelaide, Fremantle, Hobart, and Launceston. In nineteen years the quantity sold locally has more than doubled, and the ratio of wool sold to that exported has increased from 51 per cent. in 1895 to over 86½ per cent. in the season ended June 30th, 1914. During that season 1,703,744 bales of wool were sold in Australia and 264,834 bales in New Zealand, representing a total value of £26,079,536. This enormous quantity far exceeds the sales of any other country in the world, and, of course, has had an appreciable effect upon

TABLE II.—PRINCIPAL IMPORTS OF WOOL INTO THE UNITED KINGDOM, 1913

Country from which Imported	Quantity	Value
	Lbs.	£
Australia	265,078,480	12,301,380
New Zealand	181,181,381	8,165,408
Union of South Africa	133,224,202	5,095,818
Argentine Republic	55,455,562	2,140,647
France	24,492,772	1,691,611
British India	54,946,318	1,659,117
Chile	24,286,912	788,962
Uruguay	9,657,762	397,028
Russia	7,144,338	325,337
Turkey	9,428,448	274,071
Peru	5,281,190	212,300
Germany	4,717,683	210,903
Falkland Islands	6,150,514	205,424
Belgium	3,088,406	142,770
U. S. of America	2,582,876	132,160
Egypt	4,112,081	119,079
China	2,316,400	88,25
Italy	1,237,712	68,302
Persia	1,864,720	51,517
Portugal	1,421,086	48,346
Canada	724,019	25,684
Iceland and Greenland	432,847	18,097
Netherlands	345,861	12,495
Morocco	292,549	9,174
Denmark	201,618	8,803
Spain	100,523	3,277
Other countries	814,555	30,134
Total	800,580,815	34,226,103

It will be seen that of the total importations of wool into the United Kingdom, Australian wool represented over 33 per cent. of quantity and nearly 36 per cent. of value.

the dealings at the London Colonial Wool Sales. From the establishment of the London Wool Sales in 1814, the number of bales brought to London increased by tens of thousands per year up to 1901, when a great falling off began. In 1901 the total of bales offered was 1,598,986, but from the following year, when millions of sheep died in Australia owing to the great drought, the figures began to dwindle, and will probably never again reach the previous high-water mark so far as Australian wool is concerned. There was a rally during the period of the war, caused by the Australians throwing a portion of their reserve supplies upon the market, but the effect was expected to be only temporary. There is a belief among many manufacturers that both pecuniary and other advantages are to be gained by buying at the source. One of these supposed advantages is that the pick of the wool is to be obtained by sending buyers to Australia.

Of the total of 1,703,744 bales of greasy wool sold in Australia in the season ended June 30th, 1914, at an average price of a trifle over 9½*d.* per lb., 1,184,531 were purchased for the Continent of Europe, 318,661 for the United Kingdom, 90,265 for America, 20,500 for Asiatic countries, 57,353 by scourers and speculators, while 32,434 bales went for consumption in the local woollen

TABLE III.—QUANTITIES CATALOGUED AT THE LONDON COLONIAL WOOL SALES

(From the *Yorkshire Post* Annual Trade Review.)

	1912	1913	1914	1915
	Bales	Bales	Bales	Bales
Sydney	130,830	126,100	116,400	277,100
Queensland	99,340	107,000	106,300	165,900
Port Philip	106,530	87,100	67,600	38,100
Adelaide	52,400	27,000	35,300	26,700
Tasmania	12,920	9,200	7,300	6,600
West Australia	85,050	71,500	58,300	74,000
New Zealand	416,230	388,200	357,300	348,800
Australasian	903,300	816,100	749,000	983,600
Cape	42,400	35,600	22,000	47,100
Total	945,700	851,700	771,000	1,030,700
DISTRIBUTION OF WOOL SOLD AT THE LONDON AUCTIONS				
Home Trade	521,000	469,000	530,000	823,000
Export	377,000	321,000	235,000	148,000
Total	898,000	790,000	765,000	971,000
TOTAL EUROPEAN AND AMERICAN IMPORTS FOR THE SEASON				
Australasian	2,463,000	2,296,000	2,322,000	1,978,000
Cape	463,000	484,000	499,000	414,000
Total Colonial	2,926,000	2,780,000	2,831,000	2,392,000
River Plate	497,000	437,000	406,000	unavailable
Total	3,424,000	3,217,000	3,237,000	2,392,000

mills. Of the Continental purchases 56.5 per cent. went to France, Belgium, and Holland, nearly 35.9 per cent. to Germany, and 7.6 per

cent. to Austria, Italy, and other European countries.

The quantity of Australian wool scoured and washed before export is, on the average, about 20 per cent. of the total clip. With the exception of a short period in the early sixties, when the flocks of Victoria outnumbered those of the mother State, New South Wales has maintained amongst the Commonwealth group the lead in sheep production which naturally attached to it as the portion of the Commonwealth in which settlement was first effected.

The following are the official figures of Australia's wool industry in the normal year of 1913:—

Number of sheep (December 31st, 1913):—	
New South Wales	39,693,643
Queensland	21,786,600
Victoria	12,113,682
South Australia	5,073,057
Western Australia	4,421,375
Tasmania	1,745,356
Federal Capital Territory	148,875
Northern Territory	67,109
Total, Commonwealth	85,049,697

Value of Wool and Sheepskins exported:—

	£
Greasy wool (531,436,878 lbs.)	21,479,782
Scoured and washed wool (60,888,364 lbs.) .	4,381,610
Tops (3,561,722 lbs.) .	415,670
Skins with wool (number, 10,948,232) . .	2,482,059
Skins without wool (number, 155,702) . .	7,062
Total value .	£ 28,766,183

In addition to her production of wool, Australia's export trade in mutton and lamb, preserved by cold process, has now reached an annual value of two and a quarter millions, and this trade, like that of New Zealand, is likely to grow rapidly in future. Already considerable attention is being paid to the breeding of a class of sheep that will furnish both a good quality of wool and an excellent carcase for export purposes. Crosses between the merino and the Leicester and Lincoln breeds have proved valuable, and the breeding of Shropshires and Southdowns for meat and wool production is also on the increase. Australia's principal customer in this trade is the United Kingdom, which has absorbed over 94 per cent. of the total quantity exported from the Commonwealth during the past five years.

THE GREAT SOURCE OF AUSTRALIA'S WEALTH IS HER PASTORAL INDUSTRY

As it is more than likely that it will be to the wool-producing countries of the Southern Hemisphere that the manufacturing world in the future will have to look for its supplies—and the development of Cape Colony is at the moment being watched with peculiar interest—it may be of value to give a comparison of the wool marketed by the three great wool-producing places in the South. The imports of wool into Europe and North America in 1914 from Australia and New Zealand, Cape Colony, and the Argentine totalled 3,237,000 bales, 2,332,000 of which came from Australasia, 499,000 from Cape Colony, and 406,000 from the River Plate. As the River Plate bale is much larger than the Australian or Cape bale, however, an explanation is due in the interests of the Argentine. Allowing approximately for the difference in the size of the several bales, it may be said that during the five years ending 1914 the importations from Australia and the Dominion of New Zealand represent about 65 per cent. of the total.

Owing, however, to Australia showing a growing inclination to enter the frozen mutton trade, and to the Argentine finding cattle more profitable than sheep, it is believed that wool consumers will in the future look more and more to the Cape for both fine and cross-bred fibres.

The tendency to which we have referred—that of relying upon the spacious, partly-settled lands of the Southern Hemisphere—will no doubt grow stronger in future. European countries are finding it much more profitable to buy their wool than produce it themselves, for it is a curious fact that the more settled and cultivated a country is the less suitable and advantageous it becomes for sheep-raising purposes. The sheep is really a pioneer, going in front to prepare a way for cattle and wheat. The moorlands and waste spaces are, by a happy dispensation, the real homes of the sheep, not the enclosed acreage fields. England and Scotland have always found accommodation for millions of sheep on the moorlands, but even in these islands the numbers are steadily decreasing. In Germany, which formerly entered into the business of sheep-raising with thoroughness and characteristic method, there is now but a mere handful, the people of that country years ago finding that it was much more profitable to go to the British colonies for their supplies of wool. The intensive method of cultivation may be all very well for producing mutton, but it is much too costly for wool purposes only. It is better, therefore, to leave this production to such vast countries as Australia, where, in places, there are not more than two or three sheep to the acre,

and where sheep can be practically left to their natural resources until the shearing time comes round.

As to the price of wool, there can, of course, be no standard where some is home and some colonial grown, where the quantity available varies from year to year, and where the demand as well as the supply is continually fluctuating. Take, for instance, the average prices of some typical classes of English and Irish wools (stated in pence per lb.) during five years which embraced peace and war times. It will be remembered that extraordinary demands were made on wool-growers for Army clothing purposes during the latter part of 1914 and onwards:—

	1911	1912	1913	1914	1915
Lincoln wethers	9½	11¼	12	14¼	19
English half-breds	10¾	12¼	12¾	15¾	21
Super Irish hogs	11¾	13	13¼	16	21
Selected Irish wethers	10¾	12¼	12½	16	21¼
Southdowns	13¾	14¾	15¾	18½	24

The same condition of things applied to colonial and foreign wools, the contest for which caused some excited scenes on the London Wool Exchange after the outbreak of the war. The two best years for comparison are 1913 and 1915. From the *Yorkshire Observer* Wool Tables, we find that

TABLE IV.—ESTIMATE OF THE WOOL GROWN IN THE UNITED KINGDOM IN 1915

(The *Yorkshire Observer* Wool Tables)

County	Sheep and Lambs	Weight per Fleece	Total Weight	County	Sheep and Lambs	Weight per Fleece	Total Weight
	1914	Lbs.	Lbs.		1914	Lbs.	Lbs.
Lincoln	882,572	9½	8,384,434	Suffolk	269,185	5	1,345,925
Yorks. (East Riding)	411,400	8	3,291,200	Essex	172,352	4½	775,579
Nottingham	162,973	7½	1,222,297	Surrey	46,819	4½	210,685
Cornwall	349,287	7	2,445,009	Middlesex	12,070	5	60,035
Devon	777,972	7	5,445,804	London	3,550	6	21,300
Gloucester	294,551	7	2,061,857	Sussex	368,679	4½	1,659,055
Hants	282,353	4½	1,270,588	Wilts	379,133	4½	1,706,098
Oxford	171,489	6¾	1,157,550	Dorset	291,867	5	1,459,335
Northampton	349,633	6¾	2,360,022	Scotland	7,025,820	5	35,129,100
Rutland	78,588	7	550,116	Northumberland	1,104,643	6	6,627,858
Leicester	275,078	7	1,925,546	Cumberland	606,759	6	3,640,554
Warwick	226,338	7	1,584,366	Durham	233,219	6	1,399,314
Kent	891,907	7	6,243,349	Westmoreland	422,436	6	2,534,616
Ireland	3,600,581	6	21,603,486	Yorks. (North Riding)	703,698	6	4,222,188
Somerset	391,692	7	2,741,844	Yorks. (West Riding)	657,412	6	3,944,472
Hereford	308,095	5¾	1,771,545	Lancashire	335,115	6	2,010,690
Worcester	130,591	5¾	750,897	Derby	133,596	6	801,576
Stafford	201,649	5¾	1,159,481	Chester	90,021	4½	405,094
Shropshire	464,773	6	2,788,638	Monmouth	210,533	4½	947,398
Huntingdon	63,707	6	382,242	Wales	3,607,729	3½	12,627,051
Bedford	65,574	6	393,444				
Berkshire	121,256	6	727,536	Sheep and Lambs in 1914	27,886,095		156,045,574
Buckingham	160,161	6	960,966				
Cambridge	115,489	6	692,934	Slaughtered	11,190,199	*at* 3	33,570,597
Herts	67,851	6	407,106				
Norfolk	365,899	6	2,195,394	Net Clip of Wool in 1915			122,474,977

Note.—The sheep and lambs of 1914 produce the wool of 1915. The loss of wool on the slaughtered sheep, estimated at 3 lbs. per fleece, must, of course, be deducted from the total possible yield. The above figures are exclusive of the Isle of Man and of the Channel Islands.

in 1913 the average price of Port Philip grease was 14*d.*, against 20*d.* in 1915; Adelaide grease, 9*d.*, as against 12½*d.*; Cape (Eastern), 7½*d.*, against 10*d.*; Buenos Ayres grease, 6¾*d.*, against 9*d.*; and Donskoi (white carding), 9¾*d.*, against 12*d.* The scoured wools are, of course, much higher in price, and these during the war advanced 35 to 50 per cent. in the case of merinos, 30 to 40 per cent. for fine cross-bred wool, and 25 to 30 per cent. for low and medium cross-breds. At the close of 1915, Port Philip scoured merino fetched 28*d.* to 33*d.* (superior to extra), 22*d.* to 27½*d.* (average to good), and 18½*d.* to 21*d.* (inferior to average). Sydney scoured merino in the three classes ran from 16½*d.* to 32*d.*; Queensland, 20*d.* to 32½*d.*; Adelaide, 17*d.* to 29*d.*; New Zealand, 21*d.* to 31*d.*; and Cape, snow whites, 17*d.* to 33½*d.*

In an industry as old as that of wool it is hardly to be wondered at that the trade has for centuries had its own special weights and measures. During the war, the public were interested to see an announcement of the Scottish woollen drapers that in future the yard measure would be 36 inches instead of 37, the extra inch, representing the width of the thumb at the cutting off point, having in happier times been regularly given as over-measure.

Wool dealers, so far as weight is concerned,

have a nomenclature of their own. The table by which they work runs:—

				Cwt.	qrs.	lbs.
7 pounds	=	1 clove	=	0	0	7
2 cloves	=	1 stone	=	0	0	14
2 stones	=	1 tod	=	0	1	0
6½ tods	=	1 wey	=	1	2	14
2 weys	=	1 sack	=	3	1	0
12 sacks	=	1 last	=	39	0	0

British wools are usually marketed by the "pack" of 240 lbs.

The importance of the British trade in home-grown and imported wool, as well as the position this country holds in the manufacturing world, can be gathered from the statistics reproduced in this chapter, and for which the writer is principally indebted to the valuable tables issued by the Bradford Chamber of Commerce and originally compiled by Mr. Frederick Hooper, the Secretary to the Chamber up to the year 1906. For the five years 1910–14, the yearly average of wool imports into the United Kingdom was 782,300,000 lbs., the average of mohair, alpaca, and other kinds imported 41,900,000 lbs., the re-exports 318,600,000 lbs., leaving a balance retained for home consumption of 505,600,000 lbs. Of home-grown wools in the same period the average yearly clip was estimated at 131,800,000 lbs.,

the exports 36,300,000 lbs., and the balance retained 95,500,000 lbs. With the addition of 35,000,000 lbs. of wool from imported sheepskins, and 206,400,000 lbs. of pulled wool, or "shoddy," there was a grand total retained of 842,600,000 lbs. The average price per lb. of imported wool for the same five years was about 10¼*d.* and 12¾*d.* for home grown, and the total value of wool, mohair, shoddy, &c., retained yearly in the United Kingdom was £31,787,200.

We are obliged to go back again to the year 1913 for normal conditions of export. In that year woollen and worsted piece goods to the amount of 168,373,700 yards were exported, the woollens being responsible for 105,883,600 yards of that huge figure. The value of the exports of woollen and worsted goods, manufactured and partly manufactured, in 1913 was £44,241,611, made up as follows:—Manufactures, £25,978,907; yarns, £8,041,991; tops, noils and waste, £5,831,230; apparel, £3,959,299; and flocks and shoddy, £418,699.

The accompanying table giving the destination of these imports will be found of interest in view of the trade controversies which the war has set up.

The import and export of yarns is a question of especial importance to those interested in fiscal

Table V.—Exports of British Woollen and Worsted Manufactures

(Including Coatings, Stuffs, Flannels Blankets, Carpets, &c.)

Exports from the United Kingdom to—	1912	1913	1914 *
	£	£	£
Germany	2,251,305	2,082,319	1,305,187
Holland	681,539	643,919	472,112
Belgium	733,963	795,716	355,493
Russia	327,995	365,662	318,264
Sweden	126,489	145,455	125,194
Norway	91,676	91,349	100,002
Denmark	234,138	214,218	206,774
France	1,811,026	1,760,593	1,835,405
Switzerland	189,909	174,360	93,872
Portugal	33,293	36,093	27,682
Spain	105,061	102,618	91,498
Italy	497,755	506,538	465,398
Austria	563,067	450,944	387,370
Roumania	167,295	78,242	85,809
Greece	148,771	226,191	306,308
Turkey	550,248	418,942	387,658
Egypt	276,578	216,676	202,080
China and Hong Kong	132,333	956,765	661,986
Japan	856,234	1,156,765	844,994
Cuba	97,872	96,141	71,446
Mexico	154,224	114,802	19,176
Colombia	58,902	69,855	51,846
Ecuador	26,160	29,693	30,044
United States	1,182,609	1,195,360	3,894,782
Peru	160,847	160,768	135,499
Chile	693,045	677,353	359,153
Brazil	406,186	384,057	163,002
Uruguay	179,100	194,180	96,000
Argentine Republic	1,398,777	1,706,783	887,055
Other Foreign Countries	717,073	855,838	525,066
Total Piece Goods, &c.	15,848,439	15,768,750	14,506,155
Total Yarns	7,443,171	7,215,636	5,017,930
Total Tops	3,296,939	3,426,353	3,010,139
Total Noils, Waste, &c.	1,834,233	2,137,904	1,666,651
Total Flocks and Shoddy	389,179	630,276	469,460
Total to Foreign Countries	28,811,961	33,560,320	24,670,335
British South Africa	946,444	897,803	747,076
British East Indies	1,143,595	1,482,775	1,200,911
Australia	2,691,621	2,690,561	2,727,129
New Zealand	689,547	707,057	563,552
British North America	4,263,768	3,999,516	2,898,789
British West Indies	95,533	78,805	75,367
Other British Possessions	385,020	493,515	356,876
Total to British Possessions	11,230,981	11,457,565	9,289,461
Total to all Countries	40,231,261	45,017,885	33,959,796

* The European War broke out at the end of July, 1914.

matters, and in this connection it may be interesting to point out that the value of yarns exported from country rose from £3,852,998 in 1862 to £9,046,394 in 1910. Since this date the figures have declined by about £1,000,000. The imports of woollen and worsted yarns in the earliest year recorded in the Bradford Chamber of Commerce tables (1860) weighed 3,007,711 lbs., and were valued at £472,363, but in 1913 the weight of these imports had risen to 32,993,997 lbs., and the value to £3,532,656. France (£1,522,969) and Belgium (£1,409,097) sent the bulk of carded yarns for woollen manufacture in 1913, but Germany, who was responsible for only £424,337 worth of woollen yarns, headed the list for worsted yarns, and what are known as Berlin and Zephyr yarns.

Of the imports of carpets and rugs, which amounted in 1913 to 1,965,006 square yards and were valued at £698,371, Asiatic Turkey headed the list with £154,128 worth, followed by Belgium (£88,900), European Turkey (£60,250), France (£55,531), Germany (£53,738), and Persia (£53,031). Other foreign imports totalled £80,382, and British possessions sent carpets and rugs to the value of £152,411. Italy has the bulk of the trade in travelling rugs, coverlets, and wrappers, monopolising £17,873 of the total of £20,854.

Table VI.—Exports of Woollen and Worsted Textile Fabrics

(N. B.—The thousands are omitted, *e. g.*, 24,371 = 24,371,000)

Year	Cloths, Clothings, &c., all Wool and Mixed		Worsted Stuffs, all Wool and Mixed		Flannels and Blankets	Carpets	All other Sorts	Total Value of Manufactures
	Yds.	£	Yds.	£	£	£	£	£
1910	95,274	12,546	95,370	7,874	770	1,313	2,579	25,082
1911	97,717	13,303	78,495	7,124	827	1,364	2,719	25,338
1912	100,530	14,104	72,136	6,714	810	1,506	2,925	26,064
1913	105,884	14,104	62,490	6,186	796	1,537	2,992	25,979
1914	81,997	11,574	70,304	6,204	848	1,275	2,889	22,790
1915	92,446	16,491	55,790	6,100	1,775	981	2,566	27,913

A few concluding remarks on the influence of the war on woollen and worsted would perhaps not be out of place seeing how profoundly the trade has been affected by hostilities undertaken on such a gigantic scale, and how altered the conditions are likely to be in the future. There is little doubt that on the whole the war will be found to have brought something more than a temporary revival in manufacturing—always supposing, of course, that the supply of wool can be kept up to a point which allows of the raw material being purchased at a reasonable figure.

TABLE VII.—SUMMARY OF WOOLLEN AND WORSTED FACTORIES IN THE UNITED KINGDOM

(Viz., Woollen, Worsted, and Shoddy)

	1885	1889	1904 [1]
Factories	2,751	2,517	2,382
Rag Grinding Machines			900
Woollen Carding Sets			6,700
Worsted Combing Machines			2,924
Spinning Spindles { Mule	5,375,102	5,604,535	2,780,565
Spinning Spindles { Other			2,844,912
Doubling Spindles	769,492	969,812	1,059,049
Power-Looms { Up to 40 in. reed space			9,456
Power-Looms { Over 40 and under 60 in.			22,843
Power-Looms { 60 in. reed space and over			72,215
Total	139,902	131,506	104,514
Children working Half-time:—			1907
Males	11,667	11,102	4,001
Females	12,969	11,838	4,115
Persons working Full-time:—			104,837
Males	112,935	120,441	104,837
Females	145,684	158,175	148,239
Persons employed:—			
Males	124,602	131,543	108,838
Females	157,653	170,013	152,354
Total Number of Persons Employed	282,255	301,556	261,192

[1] The latest year to hand.

The war, indeed, has altered the whole complexion of things. Up to the end of the summer of 1914, when the peace of the world was so rudely broken, the trade, if not in a languishing, was certainly not in a satisfactory state—a remark which applies more particularly, perhaps, to the woollen section, which, speaking broadly, has to do with the provision of undergarments rather than the cloths and stuffs which are worn for outward adornment. Cotton had made great inroads into the woollen trade, especially in the make-up of the cheaper kinds of knitted hosiery, which had so largely ousted good honest flannel, and many old-established firms had begun to close their doors.

The figures giving the number of factories in the country are illuminating. While worsted mills during the past thirty or forty years had shown a small but steady increase in number—the number in the United Kingdom had advanced from 703 in 1867 to 841 in 1904, the latest date at which a census was taken—the woollen factories, which numbered 1,658 in 1867, had fallen in 1904 to 1,377, having reached their highest point (1,918) in 1885. It is significant, also, to note that woollen shoddy factories in the same period increased from 108 to 161, and that cotton mills, although rather fewer in number, had become

much larger, and could show an increase of millions of spindles and double the number of power-looms.

The war, it should be said, brought a slight increase in the number of woollen factories, for manufacturers of khaki cloth, Navy flannel, and general service blankets were so hard pressed to fulfil Government orders that old mills were restarted in some districts and everything possible done to increase the output. These old mills, being in many instances both inconveniently situated and badly equipped, will no doubt be given up again later on, but the call on the remainder may be expected to be permanent. One thing is quite clear, and that is that England can never revert again to such a state of military unpreparedness as existed before the European War broke out, and a larger Army will of course mean more clothing and more work for the woollen factories.

The worsted manufacturer will no doubt be little affected, for when the world gets back to the normal again, the tailor and the dressmaker will probably be as largely patronised as ever. Both sections of the trade may be expected to be exceedingly busy for some years to come, for while the mills have been kept fully engaged on Government work during the war, the stocks of the

draper and merchant have, perforce, had to run down to zero.

There will be good trade for a long time to come if, as we have already stated, the raw material is abundant and the price is "right." It has already been pointed out that the great wool-producing countries are at the moment showing a tendency to produce mutton at the expense of wool, and it largely depends on how far this tendency is realised whether the woollen and worsted trades of the future are developed or retarded.

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